THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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MINISTERS AND MARCONI.

IT is a long while since any controversy has arisen in political and commercial circles arousing such intense interest as the incidents which during the last few days have involved the conjunction in the public Press of the words at the head of this article. Ministers are never without their enemies. The name of Marconi we use, of course, in an impersonal sense. It is representative of a great enterprise, and great enterprises must have their rivals, or would-be rivals. The evidence which was begun in the libel action against *Le Matin*, and continued before the Parliamentary Committee, may have afforded some satisfaction to enemies, but has also afforded considerable disappointment to the friends of both.

The contract for the links of the wireless chain was made by the Post Office after considerable discussion and negotiation. The officials of the Department have maintained, with a tenacity which is entitled to commendation, that the terms of the contract were advantageous to the State. Whether or not the terms were the best that could be obtained, or even if the best that could be obtained from that particular contractor should have been entered into, it is not now the time to consider.

The contract, in fact, contained some exceptional conditions, and we think it probable that these exceptional conditions mainly exercised the public mind in so far as the public mind is exercised about such undertakings. The contract having been provisionally agreed to by the Government, was subject to the ratification of Parliament. Such ratification was expected promptly, as the managing director of the company remarked in a letter upon which we commented in our issue of January 24th, 1913. By both parties to the contract it is to be feared that the confirmation of Parliament was regarded rather as a matter of form than otherwise. If that be so, it was an error of judgment which was to precede many others. Until ratified by Parliament, the contract was not complete, and when it came up for ratification, it became evident that it would be necessary to have it fully considered by a Select Committee. This resulted very largely from the criticisms in the Press, which seemed to emanate principally from political opponents of the Government. Much of the criticism, even in quarters which have been called influential, was based on compounds of inaccuracies and inferences. That an important organisation could acquire an influence of its own was not recognised, and the influence which the Marconi Co. unquestionably did exercise was attributed to the relationship existing between its managing director and one of the principal members of the Government. Continuing for some time it was clearly hinted in the Press, and more definitely stated in clubs and places where they talk, that some Ministers had made money out of Marconis. This general talk was formulated by the Attorney-General in the House of Commons in October, and specifically denied on

his own behalf and that of other Ministers according to formula. This was probably the crowning mistake of the series, because it is to be feared that friends and foes alike regarded the denial as general, and omitted to notice the specific nature of the formula. In consequence, there was surprise and disappointment at the evidence in the *Le Matin* case, which showed that whilst leaving British Marconis severely alone, the Attorney-General had dealt in American Marconis, and that he was joined in those dealings by the Chancellor of the Exchequer and the Chief Whip. The distinction between the two companies, the nature of an investment, and the limitations on Ministerial thrift, have formed the substance of much evidence before the Select Committee without, we think, very material benefit. Fine distinctions of this sort seldom reach the popular mind. To the man in the street, Marconis are Marconis, and the geographical prefix is comparatively unimportant.

The exact method of reaching a conclusion may not be scientifically or judicially correct, but the man in the street will unquestionably be right in his conclusion that such action on the part of the Attorney-General, the Chancellor of the Exchequer, and the Chief Whip was singularly ill-advised. The contract had to come before Parliament. The chief law officer might have to advise, the Controller of the Purse would certainly have to exercise some discretion in such a matter, and the Chief Whip would possibly be required to exercise his functions in obtaining the presence of the necessary majority of members. No reasonable individual would suggest that they would be in any way influenced by their personal interests in carrying out their respective duties, but the fact that their interests were possibly antagonistic to their duties would seriously impair their efficiency. Whatever the distinction between the particular companies concerned, no difference exists on the part of the individual managing their affairs. The investment was prompted by the Attorney-General's brother, who had "made himself responsible for" a large issue of shares of the American company, and it was the same brother and no other who was responsible for the negotiation of the contract with the British company. The practical objection is found in the fact that in consequence of the circumstances which had arisen, the Attorney-General, who is presumed to be the most able adviser at the disposal of the Government, was compelled to ask that he should be excused from advising as to the power of the company to withdraw from the contract.

The drawbacks attending the position of the Chancellor of the Exchequer are less direct, but to the public even more important. Amongst much inaccurate statement and unreasonable inference, the writer in the *National Review* made a perfectly reasonable reference to the South Sea Bubble in connection with the Marconi companies. In connection with company promotion, it is quite common to follow one success with another, making subsidiaries upon geographical or other lines, sometimes without much reason, except that the public are ready to absorb that particular brand of share. In the case of Marconis, the geographical company is quite a reasonable branch to pursue, but the flotation on the London market of the American company at the time, and under the circumstances concerned, must be regarded as being prompted by, and should be judged according to, the methods of the company promoter. It would be improper to describe the American company as a bubble company. We do not think it would be improper to describe its introduction on the London Exchange as an inflated flotation. The participation of the Chancellor of the Exchequer in such a deal is very much to be regretted, if only for its possible effect on the investor or dabbler who, hearing of the fact, might conclude that "if it is good enough for the Chancellor of the Exchequer, it is good enough for me." The lack of worldly wisdom evinced by both the Attorney-General and Mr. Lloyd George must be regarded as one of the most remarkable features disclosed by the recent controversy. The Attorney-General was so astonished as to answer: "Good heavens! No!" when asked if the surprise telegram from a celebrated man were not a familiar feature of company promotion. The Chancellor of the Exchequer persisted in the description of his purchase of shares in a new company, with no dividend record, at an extravagant premium, as an "investment." We presume it is due to his more businesslike experience that we are able to congratulate Mr. Samuel, as we do, on having refrained from drawing fine distinctions, and on adopting the better policy of leaving the whole family severely alone.

ELECTRIC HEATING AND COOKING.

In view of the importance which already attaches to the subject named above, and which, we firmly believe, is but the merest shadow of that which it will eventually acquire, we make no apology for including in this issue an article on electric cooking apparatus, together with a report of the discussion on the subject by the Yorkshire Local Section of the Institution of Electrical Engineers. Mr. Roles, whose remarks in opening the discussion took the form rather of a paper than of a mere introduction, was clearly effervescing with information on electric cooking, derived from actual experience and observation, and could have said a great deal more if circumstances had permitted. We trust that he will find an opportunity to supplement his interesting comments on the construction of the apparatus employed for heating and cooking purposes, for it is precisely such information as this that is most urgently needed by the manufacturers, to enable them to eliminate defects and errors and to improve their products to the highest pitch of reliability and efficiency.

That many mistakes have been made in the design of the earlier forms of cooking stoves and utensils is common knowledge; but probably few were aware that the effectiveness of electric heating apparatus could be so materially influenced by small changes in construction as Mr. Roles stated. We speak of effectiveness rather than of efficiency in this connection, because of necessity, technically speaking, the efficiency of an electric heating device must be very nearly 100 per cent.; the whole of the electrical energy must be converted into heat energy in one form or another, with the possible exception of an inappreciable amount of electrical radiation. But it is evident that the mode by which that heat energy is communicated to the surroundings of the heating apparatus may have a very important effect upon the effectiveness of the apparatus as a means of imparting warmth to the person or of maintaining the temperature of a room. We are, therefore, led to make the suggestion that the whole question is one which ought to be subjected to exhaustive investigation with a view to ascertaining beyond doubt the best type of apparatus for the performance of given functions, such as heating a room, warming an air supply, and so on.

In the ordinary course, such questions as these are left to be settled by the slow and tedious process of evolution and survival of the fittest, at immense cost to the industry and the public; by the application of scientific method they could be solved in a few months, or even weeks, at a cost trifling in comparison with the resulting benefit. The same applies to cooking apparatus. Although so great progress has been made in the development of this branch of electrical service, the trade is in a chaotic condition with regard to the design of the cookers, and each maker is working along independent lines, so that a great deal of work and

trouble is being needlessly incurred, and the same ground is being trodden many times. Scientific research would soon point out the direction along which the most rapid progress would be made. One manufacturer imitates the ordinary gas cooker as closely as he can; another abandons all idea of imitation, and adopts a totally different system—can both be right? It may be observed that the gas engineers have developed a design for their cookers which is practically standardised, the differences between the various patterns being found only in minor details; their design is not necessarily the most efficient, nor yet the cheapest possible. It is, we presume, the most effective—the type which has been found by experience to be the best adapted for the public use. We want to arrive at an equivalent result by the quickest method available, and we have no doubt that an exhaustive investigation by competent researchers, carried out, of course, in conjunction with practical trials in domestic use, would take us a long way on the road to that stage of development.

The process is akin to that pursued by breeders of animals, and by horticultural experts—they do not wait for natural evolution to bring about the results they wish for; they accelerate them by judicious selection and elimination, so that it is possible, in the course of a few trials, to intensify and develop any quality that may be desired. In the same way, the Sheffield steel experts, setting themselves the task of improving tool steel, quickly evolved a steel that would stand up to heavy cuts at a red heat—a steel that is the admiration of the world. Why should we be content to leave so important a problem as the development of the ideal types of heaters and cookers to chance?

Whatever the merits of the Edison storage cell in comparison with those of the lead accumulator, it cannot be denied that the former is an engineering product deserving of the highest commendation; as a mechanical device, it is a beautiful piece of work. It did not become so by haphazard trial and error, but by scientific investigation of the highest order. Examples might be multiplied, but we must stay our hand. The point is, that the work should be done in this way; funds are needed to carry it out, but the reward would be great. The subject is one of the greatest moment to the electrical industry, both to manufacturers and to supply authorities. It is one that the new Research Committee of the Institution of Electrical Engineers might take in hand, with the certainty of valuable results in the minimum time, and we earnestly commend it to the notice of that Committee, in the hope that something may be done.

Even when the design of the actual apparatus has been settled, there is more to be considered. The whole question of heating rooms, for instance, is at present in the crudest state imaginable. We use coal fires, and stoke up until the small proportion of the energy of the coal that gets into the room has raised its temperature to an unduly high degree; the fire dies down until we notice that the room is cold, and the process is repeated. Similarly we allow the room to cool at night, and warm it up again next morning. If electric or gas radiators are used, we still follow much the same routine—we heat up and cool down irregularly. How much better it would be if, as we have previously suggested, the room were kept always at the same temperature—that which was found the most comfortable and conducive to the prosecution of our respective occupations! There is no system of heating that lends itself so admirably to the attainment of this end as the electrical system; automatic devices to regulate the consumption of power in accordance with the actual requirements are, in fact, already on the market. Where such a system is in use the supply authority has a steady load with a low maximum demand, and can afford to give the supply at the lowest possible price, while the user is relieved of all concern about the heating of his house. It would be worth while to ascertain with certainty whether electrical heating carried out in this ideal way was able to bear comparison in point of cost—including all items of expense incurred, directly and indirectly—with the cruder methods of its competitors, which, it will be noted, usually involve the provision of chimneys at considerable cost to the builder.

British Trade in Argentina.

In a recent report on the trade of Argentina, the British Consul reports that the advantageous position of British trade in Argentina is founded on the widely different economic conditions of the two countries which places each in a position to supply what the other requires. British capital and brains have found full and profitable scope for the development of railways in Argentina; the building of ports, the organisation of tramway services, providing machinery for economising and accelerating the preparation, storage and transport of grain, developing the cold storage and packing industries, advancing irrigation, water power, and land reclamation schemes, &c.; while the British flag now covers no less than 61 per cent. of the River Plate shipping—a circumstance that should in itself substantially reflect the upward tendency of our trade with Argentina. But the magnitude of British trading interests in Argentina may, perhaps, be more fully gleaned from the fact that no less than £500,000,000 of British capital is reported to have found its way into the country. The Republic, on the other hand, has attained the position of a great exporter of agricultural produce and meat, of which the United Kingdom is the largest consumer offering a growing and profitable market.

Although a study of trade conditions happily reveals British supremacy in the more important enterprises in the country, it would be unwise to ignore the progress that is being made by other nations who are gradually introducing elements of complexity into the economic conditions of the country. An effort is being made to secure a larger share of Argentine trade by the United States, and according to the figures of the Washington Department of Commerce for the year 1911-12, the imports into Argentina from the United States were £10,631,600 and exports to the United States £5,919,400, showing an increase on the general turnover of 22 per cent. as compared with the previous year. An increasing volume of business is likewise passing into the hands of our German competitors whose activity has been marked in the sugar industry, the electrical plant business, and harbour works. The following table shows the imports from leading countries in 1909, 1910 and 1911:—

	1909.	1910.	1911.
From United Kingdom....	£19,839,700	£21,875,500	£21,727,500
„ Germany	8,911,200	12,225,800	13,172,400
„ United States ...	8,613,800	9,683,800	10,470,700
„ France	6,160,200	6,730,100	7,605,300
„ Italy	5,373,600	6,355,200	5,879,200
„ Other countries ...	11,652,700	13,483,700	14,507,100
Total ...	£60,551,200	£70,354,100	£73,362,200

It will then be seen that although our trade with Argentina is still larger than that of any other competing country, our percentage of the total decreased from 32·8 per cent. in 1909 to 31·1 per cent. in 1910 and 29·6 per cent. in 1911. On the other hand, the German share increased from 14·7 per cent. in 1909 to 17·4 per cent. in 1910 and 18 per cent. in 1911; the United States' share remained much the same. Although it is only to be expected that as years go on the shares of the leading countries should show a narrower margin, there can be no doubt that part of the increased percentage of German trade in particular is due to the greater keenness shown by German capitalists and manufacturers during recent years. In view of the heavy harvests which have just been reaped, Argentina may be regarded as a profitable market at the moment, and we should lose no time in endeavouring to take advantage of the prosperous conditions. The following figures will be of interest to readers of the Electrical Review, as showing the extent of the market for their goods:

Imports of	1909.	1910.	1911.
Iron and steel, and manufactures of	£7,315,000	£8,624,000	£8,617,000
Transport carriages, wagons, &c.	6,342,257	7,019,036	7,373,075
Building materials ...	5,673,178	5,847,467	6,757,888
Manufactures of metals other than iron and steel	2,042,164	2,574,091	3,095,937
Electrical apparatus ...	843,382	1,148,306	1,336,784

A FRENCH INQUIRY INTO ELECTRICAL ACCIDENTS, AND SUGGESTIONS FOR PREVENTING THEM.

By W. STEUART, M.R.C.S., M.I.E.E., &c.

As the result of the very large number of electrical accidents that had occurred during the previous years, the French Minister of Public Works, at the end of 1909, appointed a Commission to make such inquiries and experiments as it thought advisable, and to draw up rules and regulations accordingly, with a view to reducing such accidents to a minimum.

The inquiry extended over a period of more than two years, and the results have recently been published by Dr. Weiss, one of the members of the Commission. The publication takes the form of a paper-covered book, entitled "Sur les effets Physiologiques des Courants Electriques," published by Gauthier Villars, Paris. The members of the Commission first directed their efforts to obtaining information regarding the causation of death by electricity, these observations being limited to the following groups of cases :—

1. Death from lightning.
2. Accidental shocks from industrial electrical apparatus.
3. Electrocutions in America.
4. Laboratory experiments on various animals.

As regards group 1 this was soon put on one side, as it was recognised, in the first place, that the conditions were completely different to those ruling in connection with industrial electricity, and further, through lack of competent observation, the data obtained were practically useless.

The same difficulty regarding competent observation again militated against reliable data being forthcoming in the second group, and the apparent idiocyncrasies of the current were extremely disconcerting.

Two cases were mentioned as instances in point :—In one the man received a fatal shock ; the body showed no signs externally whatever, and the most careful post-mortem examination failed to disclose any cause of death.

In the other, the victim had been horribly burned, the forearms and legs being actually amputated, and yet the patient remained alive and the general health was not affected.

The electrocutions in America, although carried out by skilled observers, did not afford much help to the Commission. The object in these cases was to kill instantaneously, so that it was impossible to judge what organ gave way first, and in what manner. Apparently the only valuable result accruing from this source was to impress the Commission with the lack of success of this form of capital punishment.

The fourth group of cases, being the experiments on animals, permitted of a complete and methodical study of the effects of the electrical current. It had one objection, viz., that it was questionable whether the results obtained from animals, such as dogs, could be applied to man.

Inasmuch as some of the experiments on the dogs were similar in degree to accidents that had happened to human beings, it may be fairly deduced that the influence of the electrical current on animals should be an approximate guide to the effect produced on men.

In all, some 44 dogs were experimented on. In each case instruments were attached to the animal to register the blood pressure, the pulse, and the respirations. The varying values were recorded on paper driven by revolving drums, the length of paper used giving an accurate measure of the time of the operation.

The pressure was registered by a voltmeter connected across the electrodes applied to the animal.

The experiments were varied by changing the pressure, current, points of applications of the electrodes, and time of application. The tests were carried out with both alternating and continuous currents, and in the former case different frequencies were tried.

The results are carefully tabulated, and copies of all the curves are given at the end of the book. Specific details of the different experiments would render this article unduly long.

Briefly, it was found that with alternating currents the frequency (between industrial limits) had no apparent influence on the results.

If death is produced by an alternating current with a pressure of less than 120 volts, it is due to the arrest of the heart in fibrillary tremors. The failure of respiration follows as the result of the heart stopping.

If death occurs as the result of a current with a pressure of more than 1,200 volts, it is due to the inhibition of the nervous centres and consequent respiratory failure.

Between 120 and 1,200 volts, both phenomena occur simultaneously.

Within certain limits death occurs with a constant number of joules, *i.e.*, the danger increases with the intensity of the current, and with the length of time the current is passing.

An alternating current is approximately four times as deadly as continuous current. Death was brought about by a minimum current of 80 milliamperes (·08 ampere) alternating and a minimum of 339 milliamperes continuous. Although alternating currents were found to be more dangerous as regards immediate effects, they have no delayed action, such as has been observed after the passage of continuous currents. There are several cases recorded in which men have been subjected to strong continuous currents, have recovered for a time, and have then become paralysed in the limbs through which the current had passed.

Currents that were selectively fatal to the action of the heart did not cause death if the heart were not included in the circuit ; *e.g.*, with the electrodes placed below the jaw and on top of the head the current did not destroy the dog, but brought about death when they were applied to the forepaws.

After the heart had entered into fibrillary tremors, no known treatment was of avail in bringing about recovery, but, in certain cases, where respiratory failure took place the respiration gradually recovered after a lapse of some 90 seconds.

From a consideration of various fatal accidents, it is probable that the reaction of human beings to the current is quite comparable to the reaction of dogs.

After due consideration of the materials obtained, the committee decided to have three sets of placards prepared. The first embodied instructions to experts, and these are to be displayed in the interior of all electrical works, substations, &c. The second set was for the general public who might not be able to differentiate between dangerous apparatus and, for instance, inoffensive telegraphic material. The third set was of an educational nature, and meant for distribution in schools.

The first set of placards commences with some general information and recommendations to be observed in all cases. The important item of advice under this heading is :—Release the victim from the influence of the current at the earliest possible moment, remembering especially that dampness and moisture render rescue work extremely dangerous.

The procedure differs according to the pressure of the current. If less than 100 volts alternating, or 600 volts continuous, no danger to the rescuer is to be feared, and the victim may be secured and pulled away, care being taken not to touch any conductor.

From 150 to 6,000 volts, it is necessary for the rescuer first to insulate himself thoroughly from the earth. This may be done by means of dry, clean bottles placed under a board, or better by some spare insulators supporting a board. If two hands are used they should both be placed on the same part of the injured man.

For pressures over 6,000 volts, rescue under any circumstances is extremely dangerous. It is necessary for the rescuer to insulate himself from earth with the greatest care, and on no account to touch the victim except through insulating material also.

The bill ends with instructions regarding first aid, &c.

The second set of placards is meant for distribution in districts supplied with electricity. The public are warned not to attempt rescue unless the accident occurs inside a house, where the pressure may be assumed to be comparatively low. Under these circumstances,

people are advised to use only one hand, to cover the hand with dry linen or dry paper, not to touch the conductors, and to stand on a chair, if possible, before attempting to pull the victim free.

Where, however, the accident occurs in connection with some form of distributing apparatus, nothing should be done beyond informing the authorities, with a view to cutting off the current and getting expert help.

It was suggested that an attempt might be made to short-circuit the victim, but it was decided that this procedure would be inadvisable; for although certain and practicable in the laboratory, the attempt would be fraught with great danger when rapidly improvised on the occasion of an accident.

In the general report the Commission lays stress on the necessity of educating the public, and especially all children at school, of the danger there is in touching electrical apparatus. It further advises that all future accidents, particularly those of a fatal nature, should be carefully studied by skilled observers, so that they may report on the conditions obtaining at the time.

One curious error has crept into the report which has escaped the notice of the electrical engineers of the Commission. Dr. Weiss deduces from an experiment that the intensity of the current is the important factor, and not the pressure. He shows that by keeping the current constant, adding external resistance, and increasing the pressure, the dog behaves in exactly the same way in each experiment, quite overlooking the fact that the potential difference across the dog remains the same.

This fallacy, however, does not affect the value of the experiments, as the intensity of the current through the body is directly proportional to the E.M.F. applied to it.

To combat the idea that an electrical shock can only take place when a person is in contact with two wires, M. Guery contributes a note showing the effects of capacity in this connection.

He first points out how on any circuit which may have developed an earth, shock is possible from a single contact, and then goes on to consider a single-phase alternating-current line with a high insulation, and shows that with a capacity of 5 microfarads the pressure to which a person touching one wire would be exposed would be $E/2$, E being the transmission voltage. Similarly on a three-phase mesh system, with a pressure of E between wires, the shock pressure would be $E/\sqrt{3}$.

Another note included in the report deals with protective clothing invented by Mons. N. Artemieff, of Kief. A similar device, however, has been known in England for some time. Trials and experiments carried out by the inventor himself showed that the idea might be of great value in practice.

The clothing is composed of a very fine metallic tissue formed in a single piece, and enveloping the whole body, including the head, hands and feet. The metallic tissue is fixed to fine cloth, and the whole garment is arranged to put on over the ordinary clothes, and is so made that it can be put on and off without assistance. The necessary gaps do not affect its efficiency provided they are closed in the prescribed way.

The clothing does not impede the workman's movements in any way.

Its protective action is twofold:—

1. The body of the operator is short-circuited by a resistance of less than ·01 ohm. The costume can take a current of 200 amperes indefinitely and 600 amperes for several seconds.

2. A man clothed with such a garment can touch any part of a high-pressure apparatus without danger, provided it is sufficiently well insulated.

Although the clothing protects against death, it cannot obviate the possibility of very serious injury.

In all probability the increased current would promptly blow the fuses or operate cut-outs, but should it not do so the operator would establish an arc on breaking the circuit, leading to the destruction of the metallic tissue and the production of very severe burns.

When testing the clothing, the inventor is said to have short-circuited a machine having an output of 200 amperes at 1,000 volts through his hands, and then to have quickly broken the circuit. The tissue was burnt in several places by the resulting arc, but the hands were not hurt at all.

Another test was the short-circuiting of a 20-KW. transformer, wound to give a voltage of 150,000 volts, without causing damage to the clothing of the operator.

NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

THE Hydro-Electric Power Commission of Ontario recently issued its third and fourth annual reports (for 1910 and 1911) under one cover.

The reports show what contracts were entered into for the supply of power to various municipalities, the growth of the load, the survey work carried out by the hydraulic department, and the work done by the municipal department in planning out distribution systems, advising and assisting local electrical superintendents in the execution of their duties, &c.

Some interesting particulars are given under the heading of "Operation of the Systems."

Before being put into operation the various items of equipment underwent severe tests, the high-tension windings of the 110,000-volt transformers and the transmission lines being subjected to a test pressure of 220,000 volts between each phase and earth.

The load factor of the system is said to be fairly high, and for 18 hours of the day the load is, roughly, 75 per cent. of the maximum.

At first, when the load was very light, the power factor at Niagara Falls was lower than 70 per cent. leading, but as the load increases it is expected that the power factor will in time be a lagging one. Some of the larger municipalities have provided synchronous motors to control the power factor of their loads.

The voltage regulation on the high-tension system is within 2 per cent.

In 1911 electrical storms were reported on 55 different days, 18 of them being severe. Six interruptions have been caused directly by lightning on the H.T. system, but contrasting it with other H.T. lines, either on the Canadian or the American side of the Niagara district, this is only about one quarter of the number of interruptions which occurred during the same season on these other lines.

An interesting fact is that out of the 120,000 high-voltage insulator sections on the line, not one has been broken due to electrical causes.

A good deal of trouble was experienced with the operation of the Commission's private telephone lines, but this has now been practically surmounted.

The foregoing particulars refer to no more recent date than the end of October, 1911; it is expected, however, that the report for 1912 will be published before long, thus bringing the information available down to a recent date.

The article headed "Electrical Apparatus and Standardisation," by Mr. W. A. Toplin, in the REVIEW of February 21st, leads one to suggest that a leaf might very well be taken out of the "National Electrical Code" of the "Board of Fire Underwriters," which has been to the fore lately in these columns.

It is well that certain things should be standardised, more particularly those articles which, owing to breakage or other cause, are in constant demand by the ordinary consumer. It should be as easy for anyone to buy a new fuse, for instance, as to go out and purchase a box of tacks. Fuses over here are standardised, but they have one great objection: all fuses for from 1 to 30 amperes are of one size and interchangeable; the step should be a much smaller one, say, 1 to 5 amperes, 5 to 10 and so on.

In this connection the German system, employing the Edison plug type of fuse, is well worth consideration,

as all the threads for a considerable range of size, are identical, and differentiation is obtained in a very simple manner by making the connection at the bottom of the socket thicker or thinner for the various sizes; thus, a 10-ampere plug will not be long enough to reach the contact at the bottom of a 5-ampere socket, and, therefore, is useless. Of course it is quite impossible to arrange any fusing device so that a person cannot *deliberately* make use of it for a greater current than is intended; the best that can be done is to make it difficult or inconvenient to do so, and to make it impossible for any to do it accidentally.

Mr. Toppin refers to the need for a means of identifying "Association" and "non-Association" cable; over here every cable maker is required by the Underwriters' Laboratories to put certain coloured threads into the insulating covering whereby each firm's cable may be known. A similar system could, no doubt, be utilised to advantage with regard to the two classes of British cable, provided that necessary safeguards were devised to prevent unscrupulous makers from putting "Association" threads into "non-Association" cables.

These notes have before this contained references to the rapid growth of some of the towns here, especially in the West.

Calgary, Alberta, started its municipal tramway system in 1909 with two cars; last year there were 48. The track mileage was 3, but this year it will be 71. The population has in this time grown from 35,000 to 75,000.

According to a recent Government report giving telegraph statistics, there were, in 1912, 168,000 wire miles of line in Canada and nearly 42,000-pole miles. Over 9¼ million land messages and more than ¾ million cablegrams were sent during the year ending June 30th, 1912.

The Grand Trunk Railway Co. is evidently satisfied with the use of the telephone for the work of train dispatching, as it is steadily extending the system, and the operation of a good many miles of track is now taken care of by this means.

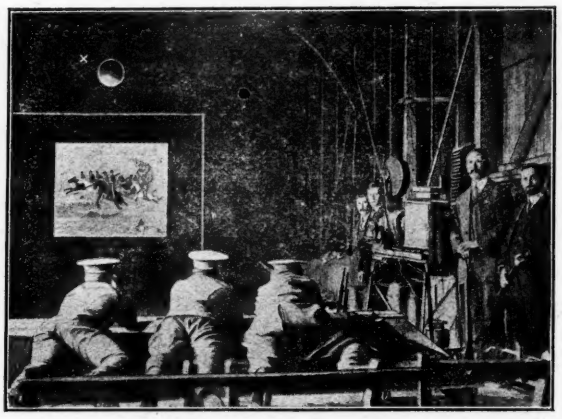
LIFE TARGETS.

The improvement of targets for rifle practice has received a powerful stimulus from the development of the "miniature," or, more correctly, "low-power" rifle clubs' movement during the past 10 years, and some very ingenious devices have been introduced with the object of lending realism to the pursuit of rifle practice and facilitating the recording of the shots; but nothing that we have hitherto met with can be compared in point of novelty and interest with the remarkable system which has been evolved by "Life Targets," of 12, Bow Street, E.C. We recently visited one of their rifle ranges where the working of the system is demonstrated, and can vouch for the excellence of the device as a means of enabling riflemen to practise under the most realistic conditions. To put the matter briefly, the marksman shoots at the images of moving objects—birds, animals, whatever one pleases—thrown on a screen by a bioscope; the report of the rifle instantaneously stops the mechanism, so that the picture remains stationary for a few seconds, while the bullet-hole, illuminated from behind, is seen as a bright spot of light on the screen, thus enabling the accuracy of the aim to be observed.

The motion of the picture is then resumed, and further practice can take place, the bullet hole disappearing from view. The means adopted to attain this end are most ingenious. The essence of the system is the use of the "KK" detector, which was described in our issue of October 11th, 1912, and was originally invented by Mr. von Kramer and Prof. Kapp for the purpose of the Railophone, described in our issue of July 5th, 1912.

The detector as used in connection with the Railophone is actuated by resonance when an alternating current of given frequency is induced in a coil carried on a railway vehicle, by a corresponding current sent through a wire laid alongside of the track. As employed in the target apparatus, however, the detector may be said to be actuated by dissonance. A microphone is fixed in the roof of the rifle range, with a trumpet directed towards the firing point, and is connected with a battery in series with the primary of a small induction coil, the secondary of which is connected to the KK detector. Ordinarily, therefore, the latter is inert; but on the occurrence of a loud noise such as the report of a rifle, the current in the microphone circuit is disturbed, and the KK detector is actuated, closing the circuit of a relay. Obviously, this having been accomplished, with the aid of electromagnetic devices and a local battery, the rest is easy; the motor driving the bioscope is stopped and a magnetic brake applied to the mechanism, instantly arresting the progress of the film; and a time-limit device is set in operation, which, after the lapse of any desired interval (3 seconds is sufficient), restores the circuits to the running condition. As the exposure of a stationary celluloid film to the rays of the projection arc lamp would cause its immediate ignition, a current of air is automatically directed upon it to keep it cool—without this or an equivalent device the system could not be operated. The air supply is derived from an electrically driven blower.

We have mentioned that the bullet holes in the screen disappear when the picture is set in motion again. The method by which this is accomplished is extremely clever. The picture screen consists of a wide sheet of stout paper wound on a roller below the target; the band of paper passes upwards, over a roller, and downwards to a third roller alongside of



x Indicates the position of the microphone.

Territorial N.C.O.'s Firing at the Life Target.

the first. Thus every bullet perforates the sheet twice. A white surface behind the target, brilliantly illuminated with flame arc lamps, forms the source of the light that shines through the bullet hole. The roller last mentioned is provided with a ratchet wheel, with which engages a pawl, actuated by a solenoid at the moment when the motion of the picture is resumed; by this means, the paper is wound up ⅛ in., and as the bullet hole is ¼ in. in diameter, the relative motion of the front and back portions of the band of paper puts the two holes out of line, thus causing the disappearance of the spot of light. This occurs at each shot, or, rather, at each resumption of motion of the picture target, as several shots may be fired simultaneously. As a large roll of paper is employed, it is, of course, desirable that it should be used over again many times; but if the paper were merely wound back and forth, the holes already made would evidently reappear. To prevent this, a second band of paper is passed once horizontally between the folds of the first band from one vertical roller to another. This sheet is perforated with the other; but by moving it occasionally the holes in the middle sheet are moved sideways out of line with those in the other sheets, and thus it is rendered so improbable that holes in the three sheets will accidentally register accurately that the contingency may be dismissed as too remote to be worth consideration. Moreover, the appearance of such a hole would necessarily coincide with the resumption of motion of the picture target and the movement of the screen, before any one could have fired, and therefore it could not lead to any mistake. By this clever device it is made possible to use the same paper over and over again, until, in fact, it is riddled with bullet holes.

It will be seen that the whole system depends absolutely

upon the aid of electricity, and the mechanism, which, we understand, is the work of several inventors and the subject of a number of patents, is exceedingly ingenious. We must express our admiration especially for the stroke of genius which utilised the KK detector to enable a sound to give rise to the motion of a relay. The effect could certainly be produced by other means, but nothing more beautiful could well have been devised than the device adopted.

The intense interest evoked in the breasts of riflemen by the "life target" is better experienced than described; rifle practice becomes a fascinating occupation when performed under such realistic conditions, and we cannot doubt that there is a wide scope for the new target, even when viewed only from the sporting aspect. But it has its serious side also, and as a means of training riflemen for military purposes it would be difficult to conceive of a more admirable scheme. The system has, in fact, been demonstrated before the military authorities, who have expressed the warmest approval of it, and there is every probability that it will be adopted by the War Office.

THE FIXATION OF ATMOSPHERIC NITROGEN.

By P. H. S. KEMPTON, A.R.C.S., B.Sc.

The increasing use of chemical or artificial manures in agriculture, especially for corn-culture in the United States, has rendered the manufacture of nitrogen compounds suitable for soil enrichment a matter of considerable economic importance.

The chief natural source of nitrates is the celebrated Chile petre beds, and some idea of the vast increase in the demands made on these beds can be gained from the following figures:—Output in 1896, 1,060,000 tons; output in 1905, 1,567,000 tons; output in 1910, 2,700,000 tons, of which 600,000 tons were supplied to the U.S.A. for corn culture. Assuming a steady increase in the demand, M. Vergara calculates that the Chile beds will be exhausted in 1923. With these facts in mind, many experimenters have turned their attention to the fixation of atmospheric nitrogen, and processes on a commercial scale are now in successful operation at Notodden in Sweden, Odda in Norway, Vevey in Switzerland, Patch, near Insbruck, and at Niagara and other places in America, water power being invariably used to drive the electrical machinery.

The choice of a substance with which to combine the atmospheric nitrogen, and thus "fix" it, is subject to three important considerations:—

1. The cheapness of the combining substance.
2. The cost of the energy used in effecting the combination.
3. The availability of the nitrogen in the resulting product, and its consequent suitability for the purpose of soil enrichment.

Obviously the cheapest and most natural substance for combination is the atmospheric oxygen, and to the production of oxides and nitric acid most attention has been directed. Next to oxygen, hydrogen has been most in favour, and many experimenters have devoted their energies to perfecting methods for producing ammonia by acting electrically upon various mixtures of atmospheric nitrogen and producer gas, Dowson gas, &c. The combination with carbon to form cyanides, and with metals to form easily decomposable nitrides, has been referred to; while the most recent, and perhaps the most promising, direction of research is in the production of cyanamides.

Fixation with Oxygen.—As early as 1785, Cavendish combined nitrogen with oxygen by means of the spark discharge. In 1863 Meissner experimented on similar lines, and found that combination was effected more easily when the gases were moist. In 1892, Sir William Crookes suggested the use of the arc, and the same idea was also used by Rayleigh in 1897. In 1900, MacDougall and Howles, using a high-tension alternating arc, concluded that the degree of fixation of the nitrogen was a function of the temperature. At about the same time Bradley and Lovejoy set up a plant at Niagara, in which 10,000-volt D.C. arcs were maintained between platinum electrodes. This undertaking ran for 15 months, and then failed, owing to technical difficulties arising with the apparatus and the smallness of the yield of saltpetre (430 kilos. per kilowatt-year). Soon afterwards, however, Birkeland and Eyde, at Notodden, perfected a process which is the basis of most modern methods of fixation. The essential difference between their method and the methods previously adopted is the drawing out of the arc into a disk by means of an electromagnet.

The arc is run at 5,000 volts A.C., and an electromagnet, placed equatorially, draws the arc out until it breaks; it then forms again, is again drawn out and breaks. This process, repeated very rapidly, provides what is, practically speaking, a "disk arc," and by suitably arranging the arc and providing a sufficiently powerful magnet (between 4,000 and 5,000 lines per sq. cm.), a disk as large as 3 ft. in radius can be maintained, and a field temperature of 3,000° C. reached. Hollow U-shaped copper electrodes are used, 2·5 cm. in diameter, which are water-cooled. The air is passed through this arc at a gentle pressure, 25,000 litres per minute being the normal rate of flow, producing 2 per cent. of nitric oxide. This nitric oxide is cooled, oxidised to the peroxide and passed into towers, where it is first converted into nitric acid and, finally, into calcium nitrate, by passing into milk of lime.

In 1910 the plant at Notodden consisted of furnaces consuming 1,500 KW., and capable of "fixing" 150 kgm. of nitrogen per KW.-year. This has recently been augmented by furnaces using 800 KW. each, and whereas the production in 1910 was 20,000 tons of calcium nitrate, the new plant is now supplying nearly 40,000 tons per annum. Larger furnaces are now being tested, one of 3,000 KW. being in regular use. Results seem to point to increase of yield, with increase in furnace power. The product which is put on the market is 75 per cent. calcium nitrate (equivalent to 13 per cent. nitrogen), and the estimated cost of production is £4 per ton. Birkeland calculates that it can be sold at a profit at £8 a ton, thus competing with the natural fertilising products, which sell at from £6-£10 per ton.

At Vevey, Moscicki and Kowalski have an arrangement in which the arc is maintained between two concentric copper poles and kept revolving by means of an electromagnet. In this way the arc is drawn out into an effective "ring arc," and the air passing through the annular space is "fixed," and the oxides produced are treated much as in the method described above. The arc is of exceedingly high frequency and voltage.

In the Badische Anilin und Soda Fabrik the arc through which the air is drawn is maintained in a tube 30-50 ft. in length, the upper end of which is water-cooled.

The arrangement of the furnace is such that the incoming air is heated to a temperature of about 500° C. by the outgoing gases.

The experimental furnaces working on this principle (the Schönherr arc) in Christiansand, work at 4,200 volts, and consume about 450 KW. In a new plant in course of erection, the arcs will be about 20 ft. long, the power consumed will be 600 KW., and the furnaces will require about 40,000 cb. ft. of air per hour.

It is claimed for this process that a 30 per cent. nitric acid is produced, and extensive experiments are being carried out at Notodden to determine the relative merits of the Birkeland and Schönherr systems with a view to installing the most successful method in the new works at Rkujan.

The furnaces used by the Salpetersäure Industrie Gesellschaft Gelsenkirchen, at Patsch, in the Tyrol, are of the Pauling type. The arc (of high frequency A.C.) is maintained between diverging electrodes and tends to spread to the widest space between them. The arc is also broadened by the stream of hot air passing over it.

The present plant consists of 24 furnaces taking 400 KW., each at 4,000 volts, and using 600 cubic metres of air per hour, but larger furnaces on this system are being installed in new works at Legnano, near Milan.

Haber and Kœnig give the following comparison of the efficiencies of the flames:—

Pauling	...	60 grammes HNO_3 per kilowatt-hour.
Birkeland	...	70 " " " "
Schönherr	...	75 " " " "

Fixation with Hydrogen.—In 1900, Hemptinne experimented on mixtures of nitrogen and hydrogen with spark and silent discharges. He found that the best conditions for combination are low pressures and temperatures and narrow spark-gap. Three years later, Schlutius, experimenting with Dowson's gas, discovered that combination with atmospheric nitrogen proceeds fairly rapidly at temperatures below 80° C. in the presence of platinum under the influence of the silent discharge. The possibility of substituting Dowson's gas for purer forms of hydrogen has rendered the manufacture of ammonia by this method a commercial possibility, but as the supplies of gas-liquor ammonia are considerable, it is unlikely that this synthetic ammonia will enter into active competition with the nitrates which are produced more cheaply by the electrical methods previously described.

Other methods involving the use of catalytic agents other than platinum (*e.g.*, uranium) have been suggested, but have not achieved any commercial success.

Fixation with Carbon.—More recently attention has been turned to the possibilities of combining atmospheric nitrogen with another cheap material, namely, carbon. This has been accomplished indirectly by the following means: Calcium carbide or a mixture of carbide and chloride is heated in a specially constructed form of electrical furnace in the presence of nitrogen. The carbide takes up nitrogen, liberating carbon and forming calcium cyanamide (NCNCa), known commercially as kalkstickstoff. The nitrogen was originally obtained from the atmosphere by passing air over red-hot copper and then reducing the copper oxide by a stream of hydrogen or producer gas in order to recover the copper, but this method has now been superseded by the fractionation of liquid air to obtain the necessary nitrogen. Attempts have also been made to combine the production of the carbide and the cyanamide in one operation, but these have now been abandoned.

Theoretically, 1 KW. should suffice to "fix" 100 kg. of nitrogen per annum. In practice little over 40 kg. are obtained. The product—kalkstickstoff—contains 20 per cent. of nitrogen, and on treatment with water yields ammonia, and thus acts as an active fertiliser. Cyanamide factories are now in existence in Italy, the United States, Norway, Germany, Switzerland and France. The largest of these works is that at Odda, in Norway, which was originally built by the North-Western Cyanamide Co. to produce calcium carbide. The present output of cyanamide from this factory is 20,000 tons annually, the plant consisting of 196 furnaces, using a total of 20,000 H.P. derived from the River Tysse, four miles distant.

CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Business in Spain.

Your recent article on the backward state of British trade in electrical material in Spain is interesting, and may spur some manufacturers who do not already know the market to make efforts and spend money to obtain the trade which undoubtedly exists.

As a British manufacturer, with a good many years' experience of Continental trade, I might mention the following:—

For the last 11 years I have regularly worked Spain with travellers, from the rank of a director downwards, including some of my most competent engineers, of course speaking the language, but they have never yet secured sufficient business to pay more than their travelling expenses.

Thinking this system might be wrong, I appointed local agents, and endeavoured by moderate stocks to obtain the trade. This method also failed.

Then I tried employing a Spanish commercial traveller, an engineer (certainly not a specialist in electrics), with a good working knowledge of Spanish requirements. The experiment was even worse than the others, and consequently I now feel the Spanish market is really no good to me. The trade is there, but the grade of material, whether accessories, fittings, motors or fans, is so low, that I find they will not even take the trouble to look at corresponding British articles, which as a rule are at least 25 per cent. more in first cost, and generally cost more to land through Customs duties, owing to their extra weight.

Further, the supply houses and jobbers of the principal cities are almost all tied houses, allied to the wealthy German, and occasionally French, manufacturers. These carry enormous stocks, and are willing to sell them at figures far below my works cost. Price, and price alone, seems the secret of the trade, and I think my experience will be found to be that of other manufacturers.

The only explanation I can offer is that so long as the German manufacturers are able to sell their machines at high prices at home (as I know from personal experience they do), they can continue with advantage to sell at dumped figures abroad. There may be some advantage to Spain as an importing country, but it effectually prevents her attempting the manufacture of this material, and as my experience shows, precludes any hope of success from England.

I should be interested to hear what other manufacturers' experience has been.

Manufacturer.

London, *March 20th*, 1913.

Failure to Excite.

I should be pleased if any of the readers of the REVIEW could explain a curious difficulty which occurred to me the other day.

I wound a small shunt dynamo to generate 60 volts D.C. at 4,000 revolutions, to act as a speedometer for a variable-speed alternator, driven from the pulley of the same, and to record on a 0-60 voltmeter to be calibrated in "cycles per second" direct.

It ran at about 3,800 revolutions as a shunt motor on 60 volts, but when driven as a dynamo it refused to excite. Separately excited on 60 volts, however, we obtained about 55 volts from the armature, but even when we helped the excitation with a few turns carrying a heavy external current, when the shunt fields were connected across the two brushes, we only obtained 18 volts on the voltmeter, which slowly fell back to zero when this helping exciting current from the external source was switched off. The machine was a two-pole machine, the armature core and field stampings being of Sankey's "Lohys" iron (it being a core as usually used for small fan motors A.C. and D.C.); the field turns 1,500 per pole, carrying about 0·15 amp., and the armature resistance, brush to brush, being about 8^{w}.

Speedometer.

Prospects in Electrical Engineering.

One of the most interesting sections in the ELECTRICAL REVIEW is the "Situations Vacant" columns, which I think are perused regularly by a large number of the profession, from chief engineers down to those young gentlemen who have studied Ohm's law for a few weeks and wish to become electrical engineers. These columns of your issue of March 28th are particularly interesting, and give one much food for thought. Take the case of a switchboard attendant wanted for an electricity works in Lancashire with three separate supplies—high tension, three-wire D.C. and traction—"should have technical school training," for the magnificent salary of 5s. per week of 56 hours (presumably seven shifts per week), which works out at 1d. per hour, with an odd 4d., with which the successful applicant can purchase the ELECTRICAL REVIEW to look for another job. This advertisement must be bad reading for some of the technical institutions.

Then, again, we notice that a chief electrical engineer is required at £500 per year clear of all expenses, and be it noted he must not exceed 40 years of age.

Now probably a young gentleman finishing a course at a

technical school notices these two advertisements, and immediately comes to the conclusion that he starts at the bottom at 5s. a week and rises to £500 a year before he is 40. Perhaps!!! He very likely consults the professor in charge of the institution at which he studies, and hears the old, old tale about starting at the bottom of the ladder, and goes straightway and takes the 5s. job, and in imagination we can hear the grunt of satisfaction of the electrical Mephistopheles, "Another one!"

The point I wish to impress is that the technical institutions do little or nothing to advise these young men. They are allowed to go to their doom without any warning, and they have not the least idea of the harm they do to the profession generally by accepting such low salaries for responsible positions.

I would suggest that the heads of all technical teaching institutions in the country should devote, say, one hour per session to a lecture on future prospects, with special reference to the danger of accepting small salaries for positions of responsibility, and perhaps reprints of articles on the subject from the technical Press could be distributed to all men finishing their course of study. Articles such as the one entitled "The Ends of the Rainbow," in the ELECTRICAL REVIEW of March 7th, 1913, would no doubt do much good. In this article is pointed out the folly of the rush to "the initial stages of a new branch of industry, or to the opposite pole when the industry becomes stereotyped." I had hoped to see some correspondence on the subject of this article, but electrical engineers seem at the present day very apathetic with regard to any subject which touches their status.

This brings me to another point—the apathy of a large number of electrical engineers with regard to the future prospects of the profession; this applies particularly to Birmingham and the Midlands.

When some members of the A.E.S.E. were visiting a number of electrical stations in the above districts, they found that a good number of the men engaged in them did not read the technical Press, and consequently knew nothing of what was going forward, other than in their own little sphere. A few back numbers of the ELECTRICAL REVIEW were distributed among them, and it is hoped that this will rouse these men to take more interest in their profession in the future. The majority are in receipt of very low salaries. Some have even dared to marry and have families. Perhaps they have heard tell of the reply which was given by a chief electrical engineer of a London supply authority when it was pointed out to him that he was paying his labourers as much as, and even more than, his engineers. He said the reason why the labourers were what he called "well paid," was because a labourer generally had a wife and about 10 children, giving the impression that if his engineers obtained a wife and a family each he would pay them a larger salary.

I must point out that any improvement must be initiated by the men themselves, in combination with their colleagues all over the country, and earnestly appeal to all electrical engineers who read this letter to come forward and help in the work that is going on to raise the status of the profession by means of the A.E.S.E.

W. J. Ebben,
Hon. Sec. Association of Electrical Station Engineers.

London, E., *March 31st*, 1913.

An Electric Cloth-Cutting Machine.—An ingenious electrically-operated machine for cutting super-imposed layers of cloth has lately been brought out by Messrs. G. Stibbe & Co., of Leicester. The machine, which is known as the "Ballard," is a compact and fairly light piece of mechanism, capable of being operated from an ordinary electric lampholder, and consuming, it is claimed, no more current than that required for a 32-C.P. lamp. Two types of the apparatus are being made, one with a vertically-moving knife, the other with a rotary disk cutter. In use the machine is held and guided by a small handle, the switch being so located on the machine that the latter can be stopped and started by a movement of the operator's thumb. The cutting blades are guarded to prevent accident or injury, and each machine is provided with a lamp for throwing a strong light on the cutting line. As the electric wire connections may be conveniently arranged for moving the machines through a considerable distance, great lengths of cloth may be operated upon. The cutters are built in three sizes, for cutting cloth layers up to 4, 5, or 6 in. in thickness.

WIRELESS TELEPHONY IN MINES.

THE system of wireless telephony described in the following paragraphs has been in regular successful operation in the Carolinengluck mine for some time past, and provides efficient communication between the pit head and stations within a radius of more than one mile from the shaft bottom. We are indebted for the particulars and illustrations to *La Technique Moderne*.

The equipment required is very simple, and the necessary primary currents can be obtained from small batteries, so that the capital outlay and working expenses are low. High-pressure high-frequency secondary currents are supplied to ropes, pipes and rails in appropriate positions in the mine, and the electromagnetic radiations from these conductors are received in suitable local circuits.

Referring to fig. 1, wireless telephonic communication can be established between the engine house and the shaft cages by (1) connecting a loop conductor *a* in the shaft lining to batteries and a microphone *t* in the machine house; (2) connecting a telephone *t* and battery *e* between the extremities of the over and under-winding ropes at each cage. These ropes and the winding pulleys form a closed circuit in which the current can be varied (by speaking into the cage transmitters), and thus corresponding variations can be electromagnetically induced in the engine-house receiving circuit.

The various strata of the soil play an important part in wireless telephony in mines. Electrically, the surface of the soil acts as a vast condenser, capable of absorbing any quantity of electricity. The lower strata act as an insulator with regard to static charges. The rails and pipes form a conducting system, sufficiently insulated by the surrounding layers of soil to be used as such—even for weak static charges.

Referring to fig. 2, a 12-volt battery in the surface sending station passes about 0·5 ampere through a microphone and the primary of an induction coil, which raises the pressure of the

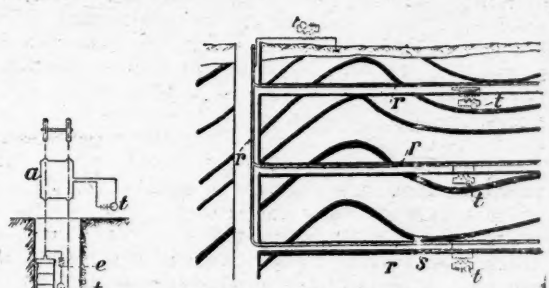


Fig 2

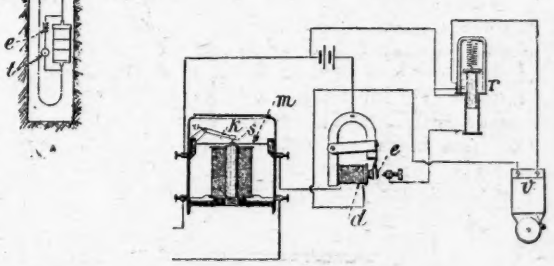


FIG. 1. FIG. 3.

speech currents to several thousand volts. The secondary of the transmitting transformer is connected between earth and a pipe line *r*, traversing the mine shaft and galleries. The feeble high-pressure speech-currents flowing through the pipe line, or other conductors in the mine, emit electromagnetic waves, and the linear conductor may be interrupted at various points without disturbing the propagation of the waves. To collect some of these radiations and translate them into sound, one of three different arrangements may be employed. The simplest receiving circuit—see lowest gallery, fig. 2—comprises a high-pressure winding connected between *r* and the rails *s*, and a secondary low-pressure circuit containing a battery and telephone receiver *t*. In the middle gallery, the high-pressure winding of the receiving transformer is simply bridged across from 15 to 35 ft. of the pipe *r*, according to the distance from the sending station. A third arrangement—shown in the top gallery—requires no direct connection between the pipe line and the receiving circuit; the high-pressure winding of the receiving transformer is connected to a loop of wire mounted parallel to the pipe line and constituting a receiving "antenna."

The chief difficulty encountered in perfecting wireless communication along these lines was to design a simple and reliable call-device. After conducting a number of experiments, M. Reinecke has secured satisfactory results with the apparatus shown in fig. 3. A note of definite pitch is emitted by an "electrical trumpet" in the sending station, and the electromagnetic waves radiated from the pipe system in the mine impinge on a receiving antenna connected to an electromagnet mounted beneath a membrane *m* in the receiving station. This membrane is set in vibration by stimulating oscillations of predetermined frequency, and then makes and

breaks the contact between itself and the style *s* on the balanced arm *k*, the adjustment of which is independent of temperature. In the first form of the call device the current normally flowing *vid k, s, m* energised a solenoid *d*, and thus held open the spring hammer contact *e*. Directly the contact *s m* was opened by the vibration of *m*, the contact *e* in a local call-bell circuit was closed. It was found, however, that purely mechanical vibrations in the neighbourhood of the calling relay might set *m* in motion, and thus give a false alarm, to avoid which a time relay *r* was included in the bell circuit, so that the latter might not be closed unless *m* was in continued vibration induced by true call-waves. As thus perfected, the call device only operates when that button is pressed in the pit-head station, which controls the "electric trumpet" tuned to the natural frequency of *m*. By tuning the membranes *m* at various stations to different frequencies, and by providing a number of electric trumpets emitting corresponding notes at the pit-head station, it is possible to call selectively the stations in the mine.

In order to simplify the equipment, the primary transformer coil at the pit-head station may be used to actuate the electric trumpet, the secondary winding being automatically placed out of circuit by the action of pressing the call button. Sparking at the trumpet contacts is avoided by the use of a shunt condenser in the ordinary manner.

The weight of the complete equipment at each station, comprising a battery of cells, an induction coil, microphone and call apparatus (the whole enclosed in a suitable case), is about 24 lb. The British rights on the invention are secured by Patent 15,256, 1912, and for a more detailed description of the system and apparatus, readers should refer to *Glückauf*, October, 1912.

ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Mr. E. Garcke presided at the Institution of Electrical Engineers on Monday at the annual meeting of this Institution. Before moving the adoption of the report he mentioned that Mr. Justus Eck was not able to be present owing to his absence in Australia travelling. Mr. Garcke then proceeded to briefly summarise the financial position to which we referred in a leaderette in our last issue. The net surplus of the year, to carry to the accumulated funds, was £682. He said that the position as shown by the balance-sheet might lead to obvious comments to the effect that the grants and benefits bestowed were few in relation to the large number of men employed in the industry; that the expenses bore too large a proportion to the receipts; and that the subscriptions collected were small in the aggregate in relation to the size of the industry. Grants could only justifiably be made out of interest on capital; the latter was at present £4,000, yielding last year about £100, so that their benefits could not be conferred upon a large scale. But the benefits conferred were not expressed merely in figures; the money was given in such a form that the gift might lead to more permanent benefit, and the objective of the Committee always was to so assist those in need that they might be able to obtain new appointments, or more permanent relief in other ways. The item of expenses (£200) might be taken as a minimum, and it would not necessarily follow that if the income were doubled the expenses would increase materially, so that the proportion might look better than now. Attention must be given to the best ways of increasing income, rather than to cavilling at expenses. By incurring greater expense they could show better results in regard to subscriptions and donations, but they must have regard to the proportion which the expenses bore to the collection, and it was not practicable for the Committee to do very much more in the way of making efforts to increase income without increasing expense. They only hoped that by constantly calling attention to the Institution and its beneficent work the various companies and firms successfully engaged in the industry might take note of the desire of the Committee to be put into a stronger position, by increase of its capital, to do the work for which the Institution was formed. The industry was capable of doing very much more in benevolence than it was at present doing. There were something like 6,000 companies and firms engaged in the electrical industry in this country, and the capital invested exceeded 500 millions sterling, and he was not expressing an unduly optimistic hope when he said that if attention was called to the needs of this Institution those engaged in the industry would respond liberally. If only a small proportion of the 6,000 firms would subscribe even the moderate amount of five guineas per annum the Institution would be placed in an exceedingly strong position. The work of the electrical industry was not very highly profitable, though exceedingly interesting, yet on that huge capital even a moderate return yielded something like 20 millions sterling per annum; therefore, it was not much to ask that a very small percentage—an infinitesimal proportion—of those profits should be put aside annually for the purposes of benefiting those who had struggled and failed. There were 450,000 people engaged in the industry, and out of that total a certain number must occasionally fail and be in need of assistance; and it was the duty of all those who made profits to put aside some of those profits for such men. There were also 130,000 investors in the electrical industry who were deriving moderate profit out of that industry, and they were dependent upon the strenuous efforts of those who were engaged from day to day in the industry. It would not be all impertinent to ask shareholders to contribute to the Institution If only 1 per cent. of those 600,000 could be induced to become members, and pay a minimum subscription of 10s. per annum, there would be a handsome and increasing capital on which the Institution would be enabled to operate. Mr. Garcke then went on to refer to the question of legacies. It was only necessary to bring to the notice of gentlemen who were able to and did make wills that it was a very desirable form in which they could help this Institution. It would lessen the expense of collection and would not involve any immediate sacrifice on the part of those who so helped. The difficulty was to bring it to the notice of those in a position to make legacies of the kind. Most people were very busy, and it was only occasionally that they gave thought to the subject, and then, when they made their wills, the existence of the E.T.B.I.' was not always in their minds. The Committee were strenuously considering the best means to adopt to constantly keep the matter before the minds of such people.

Mr. Bevis, in seconding the adoption of the report, mentioned that since making up the accounts, the Committee had invested another £300 in New Zealand stock, making a total of over £4,000 in investments.

The following members of the committee of management were re-elected: Messrs. Justus Eck, T. J. Grainger, E. F. Johnson, L. A. Lundberg, F. H. Nalder, H. Oppenheimer, W. R. Rawlings, L. G. Tate.

The names of Lord Vaux of Harrowden, director of an electrical manufacturing and other companies, Sir Ernest Spencer, a director of the Metropolitan Electric Tramways and other electrical companies, also Mr. Ernest Nash, of Faraday House, were added to the committee. Messrs. Price Waterhouse & Co. were re-appointed auditors, Mr. Garcke was thanked for presiding, and Mr. Wallis Jones suggested that legacy slips should be sent out annually.

THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

Despite the inconvenience of its date (from the exhibitors' standpoint), and despite the serious trade opposition encountered during the early stages of its organisation, the First International Cinematograph Exhibition—held at Olympia from March 22nd to March 29th inclusive—proved an unqualified success. Some 20,000 visitors were admitted on Easter Monday, and an average of 10,000 was reached on the other days. We know of no other trade exhibition which has realised such instantaneous success. The effect desired and secured was to raise the cinematograph industry to that independent status which it justly merits. In the words of one of the exhibitors—"The cinema industry has hitherto been a sort of parasite to the stage, but now that is altered." No small share of the elevating effect of the Exhibition has been due to the excellent series of Conferences arranged, and to the Industrial Welfare Section of the Exhibition which demonstrated the value of the cinematograph in social and educational work

Probably for the first time on record, no fewer than 15 distinct theatres holding separate licences and using, roughly, 250,000 ft. of film per diem, operated under one roof. Every theatre was required to comply completely with the L.C.C. Cinematograph Regulations (as regards wiring, fire prevention and building construction, &c.), and the manner in which their erection was carried out (under the control of Mr. J. W. Barber, consulting engineer to the Exhibition) was remarkable for speed and efficiency. Only those who have had close experience of exhibition work can realise the chaos which reigns on the eve of opening, when jobs which properly follow each other in ordered sequence have to be performed piecemeal and practically simultaneously, In the present case, the holiday season increased the difficulties to be overcome, and the arrangement, construction and proved efficiency and reliability of the miniature theatres formed by no means the least attractive and instructive feature of the Exhibition.

In every case the auditorium of the theatre measured 40 ft. × 20 ft., and the usual size of screen picture was 12 ft. × 9 ft. 6 in. Whatever the feature specially demonstrated—whether projector, film or screen—excellent results were secured, despite the fact that the special gangway regulations enforced involved serious ingress of daylight during the daytime.

The general arrangements made for electricity supply in Olympia, from the Hammersmith mains, have already been described in these columns. From the permanent 220-volt converter sets were supplied motor-generators or auto-converters forming part of the individual theatre equipments. These machines, which were normally required to supply from 30 to 35 amperes at 65 volts to each projector, were of various types, each of which had its own special advantages, and no one of which showed any serious defect. There were in use three Siemens, three Grevener and two G.E.C. motor-generators, in addition to a C.M.B. and two Pathé auto-converters and one Cooper-Hewitt rectifier; three theatres took current direct from the Exhibition supply mains.

There is prevalent a decided opinion that it is a mistake to run cinematograph arcs with too little ballast resistance, and we learn from a representative of Messrs. Pathé Frères that this firm prefers to use 100-volt supply in the projector circuit. The ballast loss is, of course, increased as compared with circuits supplied at, say, 65 volts, but the arc runs much more steadily, fluctuations in its resistance now exercising little effect on the total resistance of the projector circuit. It is false economy to sacrifice excellence of projection, in however small a degree, to reduced energy consumption. Whether

rectifiers, motor-generators, or "constant-current" auto-converters are used, a considerably higher ballast loss than is at present generally allowed in such cases should be tolerated.

The Exhibition has proved remunerative to its organisers and to exhibitors, and has proved a great public attraction. It has given the cinematograph industry a distinct status, and has demonstrated its remarkable technical development, and wide technical and social scope. The next exhibition will probably be held about September, 1914 (this being the first vacant date at Olympia), and will last a fortnight. At this and subsequent exhibitions the great difficulty is likely to be the accommodation of exhibitors. The success of the present show has already led to the projection of similar exhibitions in America (for July next), and in Paris (for next autumn).

In the succeeding paragraphs attention is chiefly confined to electrical features, but passing reference may be made to the interesting historical exhibits showing the early development of the zoetrope and cinematograph, and to the innumerable pieces of modern apparatus, including film perforators, cinema cameras for standard or special work, printers, developing appliances, projectors, and the accessories of each.

Petrol-Electric Sets.—Where electrical energy is not available, or only at prohibitive rates, from public supply mains, petrol-electric generating sets are coming into extensive use. Indeed, so reliable and so economical in fuel consumption have these equipments proved in service that they are now used in many districts where public supply is available at from 1 to 2d. per unit. The generating costs claimed for petrol or paraffin driven sets, now on the market, vary from 1·0 to 1·5d. per unit and the capital, attendance and maintenance costs are extremely low. Cinema halls of such size and in such numbers are now in operation in every town of any importance, that their energy demand is well worth securing and retaining by central stations. Supply from the public mains relieves the cinema proprietor of the cost and responsibility of installing a private generating plant and, to a great extent, of the risk of failure of supply. Taking these facts into consideration, there should be no difficulty in arranging, in large and medium-sized supply undertakings, a tariff which will secure cinema loads to the central station. In smaller undertakings, however, the cinema load and the time of its demand are often unfavourable, so that *either* a comparatively high charge has to be made for current *or* the supply has to be taken through an auto-converter or motor-generator from the power mains or from across the outers of a three-wire lighting network. In either of these cases, the cinema proprietor will probably prefer to install his own generating plant.

Among the excellent generating sets exhibited at Olympia mention may first be made of the "Pelapone" sets shown by the E.E.E. Co. The engine used in these sets develops from three to 12 H.P. at 800 R.P.M., according as from one to four cylinders are used, and is certainly one of the most silent and smooth-running internal-combustion engines it has been our pleasure to inspect. The quantity and quality of the fuel mixture are regulated by a shaft governor, and forced lubrication is provided to every working part. The oil consumption is ¾ pint or less per B.H.P.-hour.

Messrs. Pathé Frères exhibited several Pathé-Astor sets suitable for stationary or portable use, and providing electrical energy at 1·25d. or less per KW.-hour. Owing to the small ballast resistance required where these sets are employed, it is estimated that their use is economical wherever public supply costs more than 0·75d. per unit. The "Ballot" petrol-electric set, which we understand is largely used in Pathé halls, is a particularly compact equipment providing 12 amperes at 75 volts, and weighing, complete with all tanking and piping, &c., 2 cwt.

Messrs. Fyfe, Wilson & Co. were exhibiting their well-known "Kelvin" sets, comprising a one, two or four-cylinder petrol or paraffin engine direct coupled to a compound generator, with or without interpoles. Standard sizes of this equipment provide 50, 70, 100, 135 or 270 amperes at 60 volts, and are sold complete with all tanks, piping and electrical control gear, either for stationary or portable use. Valuable features of the "Kelvin" engine are the partial intake of air from the enclosed crank case (thus preventing the accumulation of explosive vapour therein), and a quick starting device. The latter consists in the provision of about 18° play in the sprocket driving the L.T. ignition magneto. When starting up, the engine is brought into its firing position and a plunger is released which holds the magneto sprocket still, while the fly-wheel is rotated, till the limit of play of the former is reached. The spring plunger is then thrust upwards and the sprocket flies forward (under the action of two powerful springs), and thus provides a strong spark at the moment of firing, although the fly-wheel may have been moved quite slowly by the starting handle.

(To be continued.)

Kent (Fortress) Royal Engineers.—To-morrow the Gravesend Company of this branch of the Territorial Force will hold its annual dinner, and the prizes won during the year will be distributed by Colonel Seely. The Gravesend Company is one of the two Kent "Electric Light" Companies, and has a strength of 90 N.C.O.'s and men; it consists of three sections—engine drivers, electricians, and telephonists—and is well supported by the local employers, including Henley's, which contributes 21 men to the roll. Recently the Company, although it has not been two years in existence, won a valuable cup presented by Sir David Salomons, Hon. Colonel of the five Companies forming the Corps. The officer commanding the Company is Captain C. B. Grace, and the present headquarters is at the New Tavern Fort, Gravesend. A Cadet Company has also been formed in connection with the Company.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Combined Switch Fuse and Plug.

The General Electric Co., Ltd., are making a new combined switch fuse with a plug attachment, fig. 1, for use in docks, non-fiery mines and other work where a flexible connection to a motor is employed.

The switch cover cannot be opened, nor the plug withdrawn nor inserted, with the switch closed. The cover is interlocked in the orthodox fashion, and the switch spindle carries a cam, which, when the switch is closed, presses down the upper end of a hinged steel bar. The lower end of the bar is turned at right angles and forked. In addition to its two current-carrying pins, the plug is equipped with a long steel pin, which passes through a hole in the case into the interior of the switch-box, and is so notched that it can be gripped and held firmly by the fork on the hinged bar, so that when the plug is in position and the switch closed, the fork

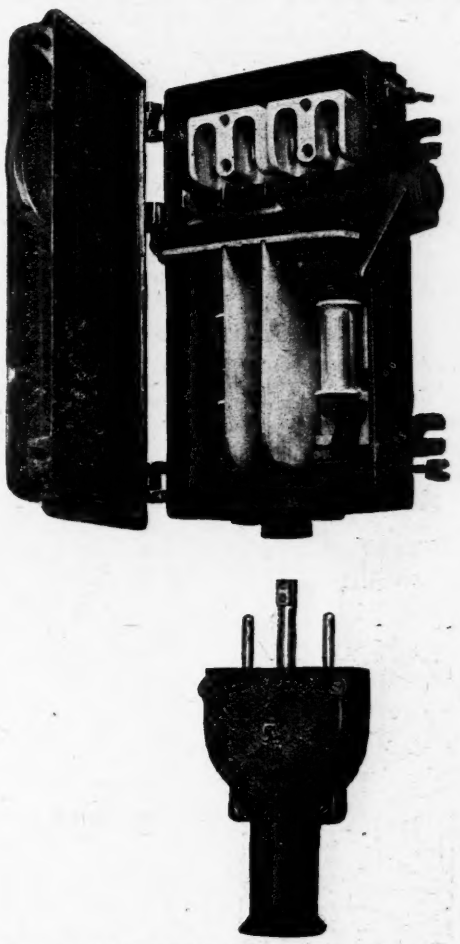


Fig. 1.—G.E.C. Combined Switch Fuse and Plug.

engages with the steel pin and absolutely vetoes all attempts to withdraw the plug. Moreover, if one tries to insert the plug while the switch is closed, the end of the steel bar effectually blocks up the aperture through which the steel pin has to pass, so that access is completely denied, and the operator is compelled to switch off before he can insert the plug.

The earthing conductor from the motor terminates at a contact in the plug, and the first step in the process of inserting the plug is to complete this earth connection. Then, and not before, the brass pins enter their sockets. On withdrawing the plug the earth connection is the last to be broken. A device is included for preventing the insertion of the plug in the reverse way.

New Type of Rheostat.

The accompanying illustrations from *L'Industrie Electrique* show a new type of automatic rheostat, which appears to offer some advantages in connection with motor starting. The principle of the apparatus is that of the hour-glass, supposed to have been rendered obsolete for chronometrical purposes in this country by Alfred the Great's calibrated candles, but still used in miniature as an accessory in the delicate operation of egg boiling.

The tube A, fig. 2, is divided into two roughly equal parts by throttle plates B, and one half is filled with sifted and dried finely pulverised carbon. The flow of the carbon particles is regulated by the cone valve C, attached to the rod D; C serves the further

purpose of distributing the carbon more or less evenly in the lower half of A. The electrodes of the rheostat are the tube A and the rod E, which is insulated from direct metallic contact with A. As carbon particles collect round E, the circuit F G is closed through a resistance which decreases (according to an exponential law) as the depth of granules in the lower chamber increases. The tube being closed, the carbon cannot burn, even when worked at high temperature; as in enclosed arc lamps, an atmosphere of carbon-monoxide and dioxide forms within the tube A. The apparatus is claimed to be equivalent to a liquid starter, while possessing none of the disadvantages of the latter.

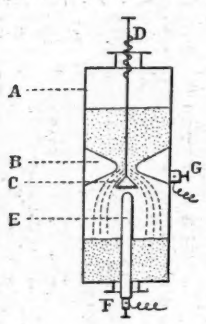


Fig. 2.

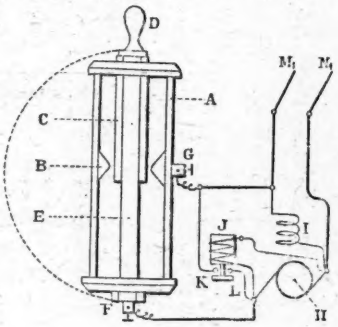


Fig. 3.

Hour-Glass Rheostat.

Fig. 3 shows the rheostat applied to starting a shunt motor H. An automatic contactor J, actuated by a pressure solenoid, short circuits the terminals F G when starting is completed.

B.T.H. Starting Compensators.

The British Thomson-Houston Co., Ltd., Rugby, have recently introduced a line of hand-operated starting compensators for two and three-phase squirrel-cage induction motors, on the auto-transformer principle, enabling these motors to be started without drawing an excessive current from the line. In fig. 4 we illustrate the N R floor type compensator, which is one of a series suitable for starting motors up to 750 H.P., on voltages from 100 to 3,300 volts. The compensator consists of a strong iron box containing the transformer and an oil-immersed switch, the operating handle of which is on the right-hand side of the case; a no-voltage release is provided on the left-hand side, and overload relays can be fixed, as shown, above the case. The switch handle has three positions—off, starting and running—and is fitted with an automatic latch which prevents its being thrown from the off to the running position, while a strong spring prevents its being left in the starting position; the handle can only be thrown by a quick movement from the starting to the running position. When the no-voltage release operates, the handle automatically returns to the off position. The overload relays also actuate the no-voltage release coil, with the same result. Fig. 5 shows the mechanism of the operating switch of one of the larger sizes of compensator, with the oil tank removed. In the case of the floor-type, illustrated in fig. 4, the switch is in the upper part of the case, and can be withdrawn together with the oil tank; the compensators are also made suitable for fixing to the wall, in which case the switch is in the lower part of the case, and the oil tank can be lowered away from it without moving the compensator as a whole. The no-voltage release coil is protected with a cast-iron cover. The largest compensators are not provided with self-contained switches, but are operated from a separate panel fitted with the necessary switchgear.

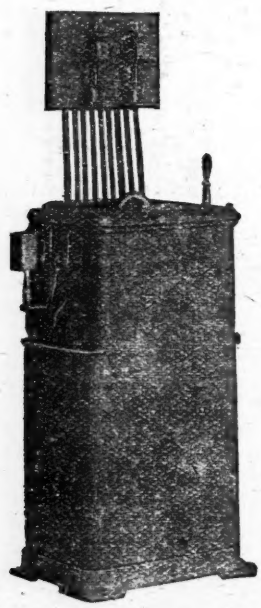


Fig. 4.—B.T.H. Starting Compensator.

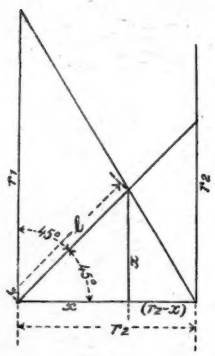


Fig. 6.

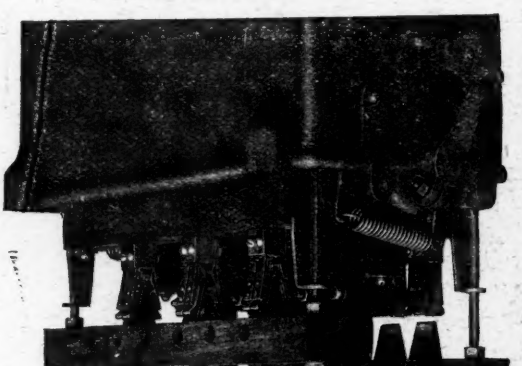


Fig. 5.—Switch of Compensator, without the Oil Tank.

Electrical Shunt Calculator.

In our issue of January 24th, 1913, we described a device for calculating the combined resistance of two or more circuits in parallel, invented by Mr. H. W. Brown, of 169, Cathall Road, Leytonstone, N.E. This device has been greatly improved by the inventor, and now consists of three scales (fig. 7), so set out and numbered that a straight line drawn from any one number on A scale to any other number on B scale will cross C scale at a point which will indicate the value of the reciprocal of the sum of the reciprocals of the numbers to and from which the straight line is drawn. Of course, there is no need to draw a line at all; the edge of a ruler will answer the purpose. It will be obvious that by means of this calculator the joint resistance of two or more resistances in parallel can easily be determined.

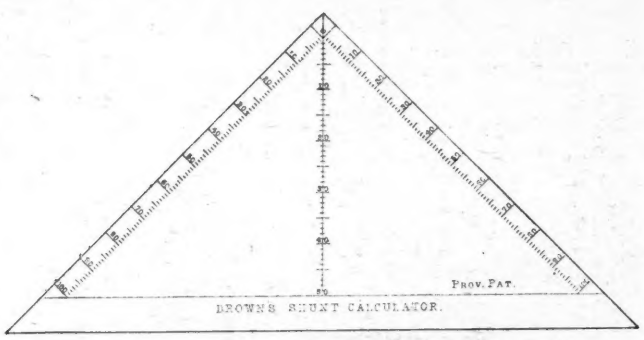


Fig. 7.—Shunt Calculator.

The mathematical explanation of it is as follows:—

Referring to fig. 6, by similar triangles,

$$\frac{r_1}{r_2} = \frac{x}{r_2 - x}.$$

Cross multiplying we get—

$$r_1 (r_2 - x) = r_2 x.$$

Therefore
$$x = \frac{r_1 r_2}{r_1 + r_2} \qquad (1)$$

But
$$2 x^2 = l^2.$$

Therefore
$$x = l/\sqrt{2}. \qquad (2)$$

Hence, substituting the value of x given in equation (1), in equation (2) we get—

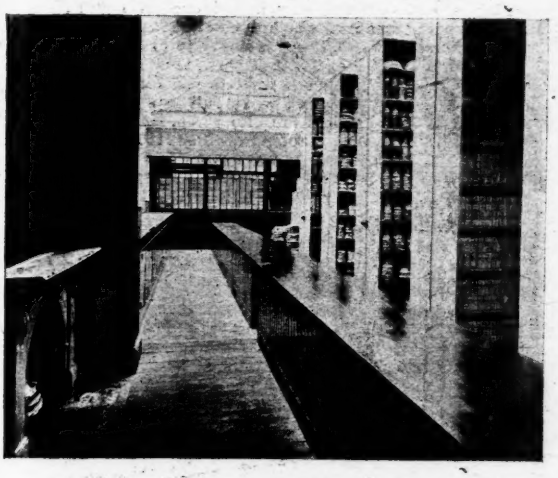
$$\left(\frac{r_1 r_2}{r_1 + r_2}\right) = \frac{l}{\sqrt{2}}.$$

Hence if the diagonal scale is expanded to $\sqrt{2}$ times the two scales at right angles to one another, the intersection point will give the value of the two resistances r_1 and r_2 connected in parallel. Similarly, the joint resistance of any number of resistances in parallel can be quickly determined, taking any two to begin with, and afterwards taking the result obtained in conjunction with another until all have been taken into account.

BUSINESS NOTES.

The "Mumps" Lampholder.—Mr. G. St. John Day, of Mumps Electrical Works, Oldham, sends us a letter respecting the qualities of the Mumps lampholder adapters, and asks us to state that particulars will be forwarded to anyone interested therein.

A Mazda House at Dublin.—The British Thomson-Houston Co., Ltd., of Rugby and London, have recently opened offices and stores at Mazda House, 25, Suffolk Street, Dublin. The building is in a central position, about 50 yds. from Grafton Street. At the front is a display window, lighted by Mazdalier and Tungstolier fittings, equipped with Veluria reflectors and Mazda lamps. In the bottom of the window are arranged a number of samples of small wiring supplies, and in the centre is a pyramid of Mazda-lamp



View of Sales Counters and Stores.

cartons. On entering, the offices are on the right, and on the left are glass cases filled with examples of B.T.H. heating and cooking apparatus. At the back of the offices are the sales counters, which are sectionalised for different classes of material. The counter is 40 ft. long, and is lighted by a glass roof. Behind the counter are bins and racks containing varied stocks of lamps, reflectors and fittings. The whole of the wall on the other side of the room is occupied by show-cases. The premises are 120 ft. from back to front, and although narrow in front, they widen out considerably at the rear. The square space at the farther end of the sales counter is utilised as a fittings showroom, and a number of ready-wired fittings are hanging from the ceiling. These include samples of Eye-rest fittings, Mazdaliers and Tungstoliers, equipped with Holophane and Veluria reflectors, and semi-indirect fittings with Holophane and Alba bowls. There is an office railed off from the

Fittings Stores and Demonstration Room.

showroom, where the clerical work of the stores is performed. On the right of the passage, coming in from the street, is the main office, which is tastefully decorated in green and white enamel. The whole of the basement is used as a stores, and it is thoroughly ventilated by a B.T.H. porthole fan. A portion of the stores is partitioned off to form a packing department, and this department opens directly into a yard leading into Wicklow Street. Large stores of electric lamps (Mazda, Gem, and B.T.H.-Edison), Veluria, Holophane, Alba and Mazdalux reflectors, Eye-rest indirect lighting fittings, semi-indirect lighting fittings, Mazdalier and Tungstolier fittings, and wiring supplies of all kinds, are carried at the new stores.

Electric Turret Clocks.—Messrs. Gent & Co., Ltd., of Leicester, inform us that they have in hand at the moment the following large turret clocks, all to work on their patented "Waiting Train" principle:—

Holy Trinity Church, Southport, with four 9-ft. 6-in. dials and striking the hours on a 2-ton bell, and taking current from the Corporation mains.
Public clock at Gulval, Penzance, with four 5 ft. 6 in. dials and striking hours and half hours on a 12-cwt. bell, with current from Léclanche cells.
Public clock for Petone, New Zealand, with four 6-ft. dials with Westminster chimes, and driven by Léclanche cells.
Three public clocks for St. Johns, New Brunswick, each with four dials, the largest being 5 ft. in diameter.
Faire Bros. & Co.'s new works, Leicester, 5 ft. dials and striking the hours on 4-cwt. bell.
United Free Church, Newton Street, Glasgow, with three 4-ft. dials.
Torquay Town Hall, with four 5-ft. 6-in. dials.
Also a special observatory transmitter, for the Glasgow Observatory.

Liquidations.—Foster Engineering Co., Ltd.—On March 14th, a petition was presented by A. F. Burman, manufacturer, a creditor, for the winding up of this company, and it is to be heard on April 8th.

Canadian Power Tramways Construction Syndicate, Ltd.—This company is winding up voluntarily, with Mr. H. G. Clarke, 3, Princes Street, E.C., as liquidator. A meeting of creditors is to be held on April 11th.

Patent Applications.—Application for restoration of Patent No. 8,207 of 1908, for "Improvements in or relating to the sinking and lining of shafts or wells," has been made by Josef Vincent Brejcha.

Mr. Charles Rudolph has offered to surrender Patent No. 9,145 of 1911, for "Improvements in unions or couplings with bayonet joints for pipes and tubes."

Trade Announcements.—The Walsall Electrical Co., Ltd., of 57, Bridge Street, Walsall, are now carrying out further extensions to their works owing to greatly increased business. It is only about 15 months since we mentioned their last extension. We understand that the firm have close on twenty times as many workmen as they had three years ago. As works alterations naturally interfere with deliveries to some extent, they ask indulgence from their clients in that respect. Within the last few weeks they have put down a large number of new tools, which will enable a resumption of prompt deliveries to be given shortly.

Mr. G. T. Bellamy, electrical engineer, of Croydon, has removed to more commodious premises at 33, Cherry Orchard Road.

Messrs. Haseltine, Lake & Co, patent agents, have removed to 28, Southampton Buildings, Chancery Lane, W.C. Telephone No., "5,611 Holborn."

For Sale.—The Glasgow Corporation electricity department has for disposal a quantity of steam-driven generating plant. The Nuneaton Corporation has for sale a main switchboard. See our advertisement pages in this issue.

Bankruptcy Proceedings. — Andrew George Adamson, electrical engineer, of Acton, lately in business at 22, Christopher Street, Finsbury Square, E.C.—April 12th is the last day for receipt of proofs for dividend by Mr. C. Mercer, the trustee, 14, Bedford Row, London, E.C.

John Mitchell and Frederick Mitchell (trading as Fred. Mitchell & Co.), electrical engineers, 97, Stockport Road, Ardwick, Manchester, and 58, Ashton Old Road, Openshaw, Manchester.—The first meeting of creditors herein was fixed to be held last week at the Official Receiver's offices, Byron Street, Manchester, but there was not a quorum of creditors present, and no business was therefore done.

Samuel Smith (trading as Smith & Sons), 22A, 24 and 26, Victoria Square, Widnes, Lancaster, electrical engineer, &c.—The first meeting of creditors herein was fixed to be held last week at the offices of the Official Receiver, 11, Dale Street, Liverpool. The Official Receiver stated that no statement of affairs had yet been lodged by the debtor, and only one proof of debt had been received. Matters were complicated by the fact that the debtor last August executed a deed of assignment for the benefit of his creditors to the trustee, who took over the assets and liabilities. Since then the business had been carried on by the debtor under the supervision of the trustee, and he incurred fresh liabilities which were now scheduled against the estate. In order to raise the money to file his petition the debtor had sold certain stock. There was not a quorum of creditors present, and no resolutions were therefore passed, the matter being left in the hands of the Official Receiver.

At the last sitting of the Bradford Bankruptcy Court, an electrical engineer's clerk, named Jonathan Edward Mitchell, of Bradford, appeared to undergo his public examination. He stated, in reply to questions addressed to him by the Official Receiver, that his deficiency was £98 14s. 6d., and his difficulties had arisen through personal extravagances and exorbitant interest charged by moneylenders in connection with loans which he had obtained. Between March 4th and November 28th, 1912, he had obtained seven loans amounting to £130, in connection with which he had to repay £192 10s., but had only repaid £87 8s. It was suggested by the Official Receiver that a portion of these loans had been obtained on the debtor's statement that he was entering for an examination of the Institution of Electrical Engineers, and that if he passed he had been promised a good position, and would get the whole of his fees back, and if he failed he would get half fees returned, but the debtor denied these statements. He said that he

had told the gentleman from whom he had borrowed the money, that he would require £30 for the examination, and £5 a week for expenses, though he denied stating that this sum was returnable if he passed, and he would hand it over immediately he obtained it. After asking some further questions, the Official Receiver informed the debtor that he had written to the secretary of the Institution of Electrical Engineers in regard to the examinations which the debtor suggested he had entered for, and had received a reply stating that such examinations had never been held. The debtor replied that there were tests of qualification for the degree of M.I.E.E., but the Official Receiver suggested that the statements which the debtor had made, that he required money for fees for the examinations, were fables and fictions of the imagination, and were fraudulently made in order to obtain money for his own personal extravagance. The debtor acknowledged that he had not paid the fees for the examination, but said that the statements which he had made as the reasons for wanting the money were not false, though later when the Official Receiver suggested that the statements that the debtor was expecting to receive a portion of his examination fees back were lies, he acknowledged that they appeared to be falsehoods. In closing the examination the Registrar (Mr. Registrar Lee) said he thought when the examination opened that the debtor, being a young man, might have been led into extravagances, but he did not think so after he had heard the replies of the debtor, because the statements that he had made were altogether disgraceful and incredible. He could not, unless he heard it from the debtor's own lips, believe that a young man, who might have been comfortably placed, could have been guilty of such recklessness and extravagant folly.

Book Notices. — The *British and Colonial Printer* for March 29th is a special export number (6d.), containing a great deal of additional editorial and advertising matter of particular interest to Colonial readers.

"Elements of Electrical Engineering." By J. L. La Cour and C. S. Bragstad. 1913. London: Longmans, Green & Co. Price 16s. net.

"*Prospectus* of the Working Men's College, 1913. Melbourne: The College.

Transactions of the University of Toronto Engineering Society." Vol. VII, No. 4. February, 1913. Toronto: The University.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 8. March, 1913. Johannesburg: The Institution. Price 2s.

"*Journal* of the Franklin Institute." Vol. CLXXV, No. 3. March, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"The Physical Review." Vol. I, No. 3. March, 1913. Lancaster, Pa.: The American Physical Society.

"The School of Mines Quarterly." Vol. XXXIV, No. 2. January, 1913. New York: Columbia University. Price 50 cents.

"Annales des Postes, Télégraphes et Téléphones," with Supplement, "La Dynamique de l'électron." By Henri Poincaré. March, 1913. Price 6 fr. Paris: A. Dumas.

"Atti della Associazione Elettrotechnica Italiana." Vol. XVII, No. 5. March 15th, 1913. Milan: Stucchi, Ceretti & C. Price L1'50.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXX, No. 2 February 1st, 1913. Santiago, Chile: The Society.

"La Télégraphie et la Téléphonie Simultanées et la Téléphonie Multiple." By K Berger and P. le Normand. 1913. Paris: Gauthier-Villars. Price 4 fr. 50.

"*Transactions* of the Illuminating Engineering Society." Vol. XIII, No. 1. January, 1913. New York: The Society. Price 75 cents.

The Trade Paper.—"The efficient trade journal proves its worth by enjoying the confidence and respect of the majority of its readers to a greater degree than any other non-human element with which these individuals come in contact. The information and knowledge which trade papers impart could not be supplied as effectively, as regularly, or as economically, to the reader by any other known method, and were these publications suddenly to disappear, great trades and industries would be left without their most effective and efficient method of intercommunication. The position of the advertiser in the efficient trade journal may be described thus:—Given a merchantable product, these journals can so efficiently place this product before the manufacturer, who is, in many cases, the consumer or converter of the product, or before the dealer, who resells, that no other method of advertising publicity can compare favourably in measured, definite value per dollar of expenditure."—C. G. Phillips in the *American Printer*.

Catalogues and Lists.—Messrs. Siemens Brothers and Co., Ltd., Woolwich.—Supplement 2 to Catalogue 517, illustrating and describing the "Rawlplug" patent plugs for use in plaster, stone, &c. The plug consists of a tube of stiffened fibres, which expand when a screw is driven home, and grip the sides of the hole, as illustrated in our last issue. One of these plugs, for which Messrs. Siemens Brothers are the wholesale agents, will stand a direct pull of 670 lb. in slate, or 140 lb. in hard plaster, with a screw ¾ in. long.

The Electrical Co, Ltd., Charing Cross Road, London, W.C. —Illustrated and priced leaflet briefly describing their electric number indicator for theatres, music halls, cinemas, &c. A simple switch operates a lever which changes the numbers, automatically locking at each point. The indicator consists of one or two 20-in. zinc figure fields, into which 2-c.p. metal-filament lamps are fitted. The connections between indicator and switch are made by means of 25-strand cables.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 20, illustrating and giving prices of the latest designs of their dust-proof and watertight cast-iron distribution boxes, fitted with their patent self-aligning fuse bandles. A separate price list illustrates and prices these low-tension self-aligning fuses.

The British Thomson-Houston Co,, Ltd., Rugby.—Two 8-page publications in their standard style, No. 4,401 containing an illustrated description and list of prices of overload relays for A.C. and C.C. circuits, No. 7,100 showing and particularising a number of types of B.T.H. fan motors and exhaust fans.

Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Publicity folder announcing that one of the largest English railway companies has placed a further order with them for about 100 miles of Armorduct 5,000-megohm grade vulcanised rubber cable.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh. — Pamphlet No. 16B (24 pages), containing very full descriptive information, with illustrations and a great deal of tabulated data as to dimensions, speeds, H.P., efficiencies, power factor, and so on, concerning the Peebles self-contained polyphase induction motors. Eight different types of standard machine covering all ordinary requirements, are dealt with. There is a very full specification of the motors, with illustrations of various parts, also outline illustrations and full lists of approximate weights and dimensions of every size manufactured by the firm, while full lists of technical data for 50 and 25-cycle motors are also given, machines being dealt with for three separate ranges of voltage from 110 up to 3,500 volts, at speeds of from 1,500 down to 150 R.P.M.

The Power Plant Co., Ltd., West Drayton.—Small folder, giving a specification of their self-contained mill gears.

The Cleveland Electric Storage Battery Co., St. Louis.—Illustrated leaflets respecting their lamps, &c., for motor-car lighting, ignition batteries, &c.

Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Two illustrated leaflets have been issued. No. 50/1 gives particulars of the firm's patent adjustable time-lag device for overload circuit-breakers; No. 450/1 describes and gives dimensions of brake solenoids for C.C. up to 600 volts.

The General Electric Co., Ltd., of 67, Queen Victoria Street, London, E.C.—A number of illustrated and priced trade leaflets have been issued: No. E1,664, describing cylindrical dust bellows; No. 1,671, describing sliding resistances for fine regulation; No. C1,668, detailing the "Armearth" system of cable protection (a new leaflet cancelling a previous one); and card C1 672, describing "Geekoduct" conduit-system porcelain block connectors and griptight continuity fittings.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, W.C.—Illustrated and priced publication, No. 722, dealing with "Aston" indirect lighting fixtures fitted with metal reflector bowls, and semi-indirect fixtures with Holophane or alabaster bowls.

The United Electrical Manufacturers Co., 89 and 90, Milton Street, London, E.C.—Advance illustrated price list of the 1912-13 season, of electric flashlights, batteries and measuring instruments.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—Leaflet respecting their new "type 462" S.P. ironclad service fusebox, also pamphlets dealing fully with house service safety fuses and "Melda" house water pumps.

Mr. H. C. Slingsby, Old Street, London, E.C.—List No. 50 giving illustrations and prices of all-steel tubular wheel-barrows.

The Universal Electrical Manufacturing Co., 14, Station Parade, Peckham, S.E.—April folder, with calendar for three months, concerning their combined ironclad switches and fuses.

Messrs. Scholey & Co., Ltd., 151, Queen Victoria Street, London, E.C.—Fourteen-page catalogue with information relating to "Indestructible" cable of various grades for outdoor and indoor service. Outdoor cables are protected against atmospheric and chemical effects by the use of a jute braiding, which is impregnated on a special system. For both high insulation (suitable for 2,000 volts) and atmospheric protection, the firm supplies a grade in which the conductor is insulated with a double layer of impregnated paper, a spiral layer of cotton, and the special braiding mentioned. A third grade is suitable for up to 10,000 volts. A braided and impregnated rubber cable is supplied for indoor service, carried on insulators, and is used by the G.P.O., railway companies, mines, &c., for lighting and power; after 10 years' service the insulation results are most satisfactory. The pamphlet gives tabulated sizes, weights, code-words, prices, &c.

A Model Gas Engine.—To explain the working of the "Duplex" valveless gas engine, which was fully described in our issue of October 11th, 1912, Messrs. Mather & Platt, Ltd., have issued a working model showing the action of the mechanism, in the form of a book. One view shows the engine cylinders in plan; on lifting the cover plate, the cylinders, which in this engine are single-walled castings, are seen fixed in a tank which contains the cooling water. The other view is a side elevation; the raising of one flap removes the side of the cylinder tank, showing the cylinders and the method of supporting them. Removing a second flap, the interior of the cylinders and pumps is exposed, showing the pistons, and by turning a disk at the foot of the model, the several pistons are set in motion in correct relation with one another; the pistons and ports are lettered to correspond with a brief explanatory description facing the model. By this means the cycle of operations of this interesting engine is made perfectly clear and easy to follow. The air and gas pumps are provided with a sleeve valve, which also is set in motion in the model, showing that the scavenging air is blown through the cylinders before any gas is admitted, and that after the gas charge is delivered to

the cylinders a following charge of air drives any of the mixture that remains in the ports into the cylinders. The pistons receive an impulse at every stroke, like a double-acting steam engine. The sleeve valve is not exposed to hot gases, but only to the charge of air and gas; and there is no other valve, the admission and exhaust ports being uncovered and covered by the working pistons themselves. The model is certainly very novel and ingenious, and admirably illustrates the unique cycle of operations followed in this remarkable gas engine. The mechanism of the model is operated by means of fibre gear wheels, with links to drive the pistons, &c.

Aluminium for Power Transmission.—While the conditions governing the erection of overhead transmission lines in this country are by no means as favourable to aluminium as those under which long-distance power transmission schemes are installed in countries where water powers abound, if a comparison be made, it will be found that the cost of construction is well in favour of aluminium as compared with copper. As considerable doubt has been expressed upon this point, the British Aluminium Co., Ltd., have plotted a series of curves showing the relative permissible sags of copper and aluminium overhead conductors of varying span, cross-section, temperature and wind pressure, in accordance with the Board of Trade Regulations. These data are embodied in a neat little book, containing "in a nutshell" the information necessary to make a comparison between copper and aluminium, and demonstrating the truth of the foregoing statement.

LIGHTING and POWER NOTES.

Aldershot.—The Gas, Water and District Lighting Co. has applied to the B. of T. for consent to construct a generating station at the gas works in Ash Road, in order to enable the company to supply electricity within the parishes of Ash, Normandy and Seale.

Argentina.—The lighting of Buenos Ayres is undergoing a steady transformation, and the kerosene lighting in the outlying districts is being replaced by gas and the electric light. At the present time public electric lighting consists of 2,531 arc lamps, with an equivalent of 3,531,000 c.p. In accordance with the recent arrangement between the municipality and the Compania Alemana de Eléctricidad, the company has agreed to install, at its cost, 4,000 arc lamps at the rate of 1,333 per year, so that in 1915 the city will have 6,500 arc lamps in service with an equivalent of 6,500,000 c.p. The gas lighting of the city is in the hands of the Primitiva Gas Co., which has actually in service 18,037 lamps, and in four years' time this number will be increased to 20,000, as the company has made a contract with the authorities similar to that of the Compania Alemana for a period of 15 years. There are also 2,181 alcohol lamps and 3,650 kerosene lamps.—*Review of the River Plate.*

Bedford.—A L.G.B. inquiry was opened on March 26th into the application of the T.C. for a loan of £11,590 for electricity purposes. Mr. R. W. L. Phillips, electrical engineer, stated that it was proposed to install a Diesel oil engine coupled direct to a 400-kw. Siemens alternator, and the tender of Messrs. W. H. Allen, Sons & Co. had been provisionally accepted. Questioned by the inspector, Mr. Phillips gave the list of tenders received, viz., Allen & Sons, £8,980; with own generator, £9,790; Hick Diesel Co., £7,160; with own generator, £9,335; Willans & Robinson, £9,429; with additions, £11,369. He added that the tenders of the Hick Diesel Co. and Willans & Robinson were not in accordance with specifications, as there was not sufficient protection of the working parts. The inquiry was, in the end, adjourned for inquiries to be made respecting statements made by the London manager of the Hick Diesel Oil Engine Co. respecting their tender.

Blackpool.—It has been decided to officially inaugurate the new plant at the electricity works on April 23rd, when members of the Council will be invited. The two new turbo-generators will be ready for starting, and in addition an installation for electrical cooking will be on view, and by way of refreshments members will be asked to test samples from the electrical stoves.

Brighouse.—A scheme is being put forward by the Corporation for electrically driving the machinery and plant at the sewage outfall works, and for this purpose a sum of £250 will be included in the estimate.

Burnley.—The increased demand for electricity for lighting, power, and traction, has led the Electricity Committee to take into serious consideration an extension of plant and service mains. The General Purposes Committee last week adopted a report suggesting the following:—(*a*) The installation of a 2,000-kw. turbo-alternator, with two 500-kw. rotary converters and transformers at the electricity station; and (*b*) the erection of a sub-station near the tramway depôt in Colne Road, containing two 300-kw. rotary converters, one for lighting and one for traction, to supply certain districts. The proposed extensions will necessitate extensive alterations to the traction switchboard, and the Committee recommends that the traction and h.t. boards be mounted on a gallery, and that the cellular pattern of switchboard be dispensed with and replaced by a type similar to that supplied for the last turbine installation. The cost of switchboard alterations will be heavy, but the Committee is advised that they should be carried out. Three small boilers in use since the commencement of the undertaking had been sold, and the Committee proposes to install two large boilers to replace them. It is also proposed to raise the pressure of three existing boilers from 130 to 160 lb. per sq. in., necessitating a new set of economisers; and to install a cooling tower with a capacity of 180,000 gallons per hour, or rather more than is required for a 2,000-kw. plant. The electrical engineer estimates the cost of the new works at £28,171, including one 2,000-kw. turbo-alternator, with condensing plant, £7,000; two 5,000-kw. rotary converters and transformers, £2,500; new switchgear and alternators, £2,200; cable and connections, £450; two boilers and mountings, £1,300; superheaters, £250; economisers, £709; stokers, £140; boiler pump, £180; water softener and piping, £500; cooling tower and piping, £800; engine room cranes, £600; a total of £17,660. The sub-station estimates are:—Buildings, &c., £1,300; rotaries and transformers, £2,000; switchgear, £800; sub-station cables and connections, £150; a total of £4,250. Two miles of ·05 three-score cable in duplicate, £3,700. Allowing for contingencies, the grand total is £28,171.

The 1910 loan of £5,000 for mains and services will be exhausted during the summer, and the Committee recommend that the L.G.B. be asked to sanction a loan of £7,000.

The T.C. is now to be asked to authorise application to the L.G.B. for sanction to borrow £28,171 for additions, &c., to the electricity undertaking, and £7,000 for electrical mains and services.

Canada.—The Windsor, Ont., municipality is to take 2,500 h.p. of hydro-electric power from the Commission, which will extend its 110,000-volt transmission from St. Thomas to Windsor—110 miles—for the purpose. The existing transmission from Niagara to St. Thomas is 135 miles long, so that the Niagara-Windsor transmission will cover 245 miles and be one of the longest in the world.

Chester.—At the meeting of the T.C. held on March 26th, it was agreed by 29 votes to 2:—(*a*) That the extension of the electricity works as suggested by the electrical engineer in his report dated March 7th be carried out at a cost of £11,550; (*b*) that application be made to the L.G.B. for sanction to borrow £7,550 in amounts to be repaid within the following periods:—£1,700 for buildings, 30 years' period; and £5,850 for battery, booster, switchgear, instruments and connections, seven years; (*c*) that the remaining £4,000 required be paid out of the reserve fund. It was also agreed that £500 of the net surplus revenue of the electricity undertaking for the current year be at the option of the Finance Committee, either carried to the credit of the local rate or applied to the improvement of the district under the provisions of the Chester Electric Lighting Order, 1890.

Mr. Britton's report, on which the Committee's recommendation to the Council was based, drew attention to the inadequacy of the plant last winter, when the maximum demand on the works reached 1,595 kw., being in excess of the normal capacity of the undertaking; he pointed out that this and the new consumers which will be added before next winter will appropriate the capacity of the hydro-electric extension for maximum load purposes. After considering the alternatives of steam and oil generating plant and storage batteries, he concluded that the most economical arrangement was to fully employ the hydro-electric plant by installing a storage battery at the New Crane Street works, to accommodate the electrical energy in excess of the demand during the night for use on the peak load of the following day; this surplus energy obtainable from the water-power plant at no additional cost will replace energy generated at the most costly period of the day. The battery recommended will have a net capacity of 550 kw. for three hours. Although the loan period for the battery is seven years, as compared with 15 years for generating plant, Mr. Britton estimated that the total annual expenditure would be from £620 to £1,530 per annum lower than if the latter plant were adopted. He further added that had steam plant been installed instead of the water-power plant, an extension either of generating or battery plant would now be required, and battery charging from steam plant would have been more costly that the proposed arrangement.

Clacton-on-Sea.—A L.G.B. inquiry has been held into the application of the U.D.C. for a loan of £6,000 for additional plant at the electricity works, viz., a Diesel generating set. There was no opposition.

Continental Notes.—Belgium.—An electrically-operated winding plant is to be installed at the Malassisè pit of the Société des Charbonnages des Kessales, at Jemeppe-sur-Meuse.

A new generating station of a capacity of 4,000 kw. is approaching completion at Langerbrugge, near Ghent. It has been established by the Compagnie des Centrales Electriques des Flandres, and will supply current for lighting and power purposes to an area having a population of about 75,000.

The municipal authorities of Lierre recently invited tenders for the concession for the establishment and working of a central electric lighting station in the town. Apparently the conditions were of too onerous a nature, as not a single offer was received.

France.—A new company has just been formed in Paris (41, Rue de Provence) with a capital of £80,000 and the title of La Société de Distribution de l'Electricité de l'Ouest.

The Société Hydroélectrique des Basses Pyrénées, whose several networks have hitherto been fed from the generating station at the Val Carlos fall, on the Spanish frontier, are now about to construct a second station on the Nive at Banca, where a fall equal to 4,500 h.p. is available. This station will be joined by two 30,000-volt lines to the steam generating station at Pont-de-Mongerre near

Bayonne owned by this society. The distribution systems which supply Bayonne, Boucau, Osses and Cambo are also to be considerably enlarged. The programme in course of execution comprises for the 30,000-volt network, besides the two lines previously mentioned, a line serving the important industrial region of Boucau and a line to supply the Bayonne-Lycée-Biarritz tramway, hitherto worked by steam, the conversion of which is expected to be completed by September next. Further, a 5,000-volt network will supply, on one hand, the Basque coast as far as St. Jean de Luz and Ascain, and, on the other, the communes in the Landes region.—*La Lumière Electrique.*

Germany.—The Ruhrthalsperrenverein, of Essen, which is installing a large plant to utilise certain available water-power in the Ruhr valley, has placed a contract with Messrs. Bregleb, Hansen and Co., of Gotha, for the supply of four Francis double spiral turbines, each of 2,000 H.P., and four single spiral turbines, each of 1,000 H.P.

The Bavarian Minister of the Interior has addressed to local authorities the following official instruction with regard to the provision of electricity in this kingdom:—That (1) the supply of electricity is only possible by means of great bulk supply stations, serving large areas and pledged for long periods. (2) That the erection of such stations in each district must be relegated to separate companies, communal or other, or to large electric supply companies working in conjunction with banks. (3) That power must be generated to the utmost from the State-owned water resources. (4) That the bulk supply stations must be bound to serve every locality within their area at a unit price. (5) That the larger, and especially the municipal stations, must construct their own networks, taking energy from the bulk suppliers. (6) That rural authorities must leave the distribution of electricity to the bulk supply concerns, retaining merely the power of repurchase at some specified date. (7) That in areas where the supply will involve loss to the suppliers, special terms may be made, subject, however, to the State's approval. (8) That the price of current must be approved by the State and revised at stated periods. (9) That pre-emptive rights over the bulk supply stations must be retained by the State. (10) That bulk supply stations are to be built according to such plans, and in such sequences and at such periods as fixed by the State. (11) That the bulk supply concerns are to refrain from restricting free competition in such portions of installations not carried out at their own cost, especially in internal fittings; and, lastly, that the State will retain sensible touch with all the bulk supply stations with a view to conserving the interests of the general public. These conclusions are said to be the outcome of exhaustive investigations into local electrical circumstances, and of an inspection of the arrangements come to in other countries.—*Elektro. Nachrichten.*

The Rheinisch Westfälischen Electricitätswerke intends to construct a large new power station on the left bank of the Rhine near Zeche. The first equipment will include two 25,000-H.P. steam turbines.—*Zeit. f. d. g. Turbinenwesen.*

Negotiations are proceeding between the Rheinisch-Westfalischen Elektricitätswerke and the five populous industrial Kreise of the Lower Rhine with respect to the completion of the distribution network and the construction of a special generating station. The five Kreise are prepared to place a loan of £525,000 at the disposal of the company, but the latter requires a larger advance (£750,000) in view of the fact that widely scattered and relatively unremunerative agricultural districts will have to be included in the completed network. A special opinion is to be taken on the merits of the divergent contentions, but it is considered in competent quarters that the company's standpoint will be eventually adopted.—*Elektro. Nachrichten.*

The Government of the Grand Duchy of Mecklenburg has just published its plans for providing electricity to the whole of the Grand Dukedom. It is intended to erect a large power station in Schwerin, at a cost of £100,000 for the supply of current to the whole of the south-western portion of the Grand Duchy. The remainder of the province will be served by another station; but, alternatively, a large transformer station may be substituted, in which event the current will be furnished by the Schwerin station. These plans obviate the resort to the private bulk supply station at Lübeck, in the neighbouring principality.—*Zeitschrift für Elektrotechnik und Maschinenbau.*

Norway.—According to official statistics, the number of electrical installations existing in Norway on July 1st last was 1,250, an increase for the 12 months of 100; the total generator capacity was 417,607 KW., an increase of 155,512; the number of accumulators in use remained at the same figure, 9,136; the utilised power for lighting in kilowatts is not on record, but in the foregoing period was 38,129; for motors it was 126,568, an augmentation of 28,856: the power used in the electrochemical industry totalled 211,131 KW., an increase of 114,345, and for other purposes 11,947, showing, however, a shrinkage of 4,418; the number of glow lamps in use was 980,317, representing an increment of 175,382, while arc lamps figured at 5,815, no record being made in the previous year. The number of motors in use was 12,825, an advance of 2,599. The Rjukan station, to serve the saltpetre industry, was opened during the official year.—*Elek. Zeitschrift.*

Russia.—At the commencement of the present month the Société d'Electricité d'Odessa was supplying current to 3,588 consumers, with a total of 129,000 lamps and 116 electric motors, equal to a consumption of 4,540 KW.

Considerable additions are to be made this year to the iron works and collieries of the Union Minière et Metallurgique en Russie, the new plant including an electric power station comprising three gas engines and dynamos, each of 2,000 H.P.

A new company is being formed in Moscow with a capital of 6 million roubles, and the title La Société de Transmission Electrique.

Spain.—The special commission for the reform of the public lighting of Madrid has advised the municipality to declare the competition for the public lighting concession abandoned, and instead to raise a loan with the assistance of the Government, with a view to the establishment of a municipal installation, procuring current from the State-owned generating station on the Isabel II Canal.—*Electron.*

The municipal authorities of San Juan de Palamos (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Switzerland.—A water-power plant is being installed at Martigny, utilising a head of 5,400 ft., through 3 miles of steel pipe. This will be the highest head of water so utilised in the world, the water pressure at the turbine being about 2,500 lb. per sq. in. Pelton wheels, with a total rating of 15,000 H.P., will be installed, and the *Electrical World* points out that only about 30 cb. ft. of water per sec. will be necessary to develop the full 15,000 H.P. output.

Darwen.—There is a movement on foot to extend the electrical undertaking to the village of Hoddlesden. Messrs. Carus's new mill, and Messrs. Place's works, are already driven by electricity, and it is now proposed to ask for current for lighting purposes. Large firms and chief residents are willing to adopt electric lighting if the Corporation can see its way to supply it.

Doncaster.—Sitting in committee, the T.C. has decided to apply for sanction to borrow £12,500 for the extension of the plant, and also for structural alteration at the Corporation electricity works. It is proposed to put in a 1,000-KW. turbine set, bringing the total plant capacity up to 2,800 KW., and to adopt H.T. three-phase supply in order to reach the outside districts which are so rapidly developing owing to colliery enterprise. Alterations will be made at the electricity station, so that, as the additions to the plant take place it will not be necessary to build a new station, the present one being sufficiently large for many years to come.

Dunfermline.—In view of impending developments in the district, the Fife Electric Power Co. has in contemplation a large extension at its works at Townhill. It is proposed to install a horizontal turbine set of 5,000 H.P., capable of developing 3,000 KW. With the necessary boiler power, the company will be able to supply double its present load.

Halifax.—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £4,380 for the supply and fixing of two water-tube boilers and superheaters required at the electricity works.

Haslingden.—At a meeting of the T.C., held on Wednesday, last week, a letter was read from the L.G.B., sanctioning the borrowing of £3,750 and £1,500 for the electricity undertaking purposes.

Heston-Isleworth.—The Electricity Committee of the U.D.C. has decided to charge 4d. per unit for current supplied to the refuse destructor works for lighting purposes, and 1½d. per unit for power, instead of a uniform rate of 2d.

The seal of the Council has been affixed to an agreement with the Isleworth Brewery Co. for supplying its premises with current, and for laying down the necessary cables.

Leeds.—The Corporation Tramways and Electricity Committee has asked the Finance Committee to apply for borrowing powers to the extent of £168,500, which it is intended to apportion as to £38,500 for additions to the generating station, £100,000 for mains, and £30,000 for building sub-stations. The Committee also proposes to borrow £28,000 for building and equipment of a new depôt in Sovereign Street.

The Corporation has a proposal in hand to reduce the price of energy for power purposes, and an additional discount is suggested for large consumers who take H.T. supplies and thus save the cost of transforming to low pressure.

Leyton.—Application is to be made to the L.G.B. for sanction to borrow £1,000 for services, and £5,370 for mains. An additional feeder is to be laid in Hainault Road at an estimated cost of £2,370. The estimated surplus on the working of the undertaking during the year ended March 31st is put at £951, of which £500 is to be set aside as a provision for the purchase of stores rechargeable to capital account as and when expended, and half of the balance, £225, is to be carried to reserve, while the remainder will be transferred to the credit of the district rate.

London.—Lewisham.—The B. of G. on Monday considered the question of installing the electric light at the infirmary and workhouse. A letter was read from the South Metropolitan Gas Co., stating that it would have been necessary for it to enlist the co-operation of a third party to undertake the responsibility of providing electrical plant and accessories, as distinct from gas engines, but the Guardians insisted that the installation should be the property of the gas company. The company had no doubt whatever as to its ability to generate electricity in the institutions with a gas-driven plant, and show a reasonable profit on the transaction. The Guardians decided to acknowledge the letter with thanks. A letter was also read from the South Metropolitan Electric Light and Power Co., offering to supply electricity for lighting at 2d. per B. of T. unit, and at 1½d. for heating, driving of electrical motors and ventilating, for 21 years, determinable at the end of the first 7 or 14 years by the Guardians only by giving 12 months' previous notice. The Board decided to accept these terms. The tenders received for the electric wiring of the two institutions are stated in our "Contracts Closed."

Londonderry.—The electrical engineer has submitted a report on probable cable extensions required during the next five years, and the E.L. Committee has approved it. The estimated cost of the extensions is £13,000.

Manchester.—The Electricity Committee proposes to apply for powers to borrow £75,000 for mains and services, and plant at consumers' sub-stations. The estimated increased revenue per annum is £12,000, against which working expenses, interest and sinking fund, amounting to £9,913, are to be set, leaving an annual surplus of £2,087, which represents a return of 2·78 per cent. upon the capital outlay involved. The Finance Committee raised no objection to the proposed application.

Oulton Broad.—The Board of Trade has revoked the 1908 Electric Light Order.

Portishead.—The Clevedon, Portishead and District Electric Supply Co. has applied to the B. of T. for permission to use overhead lines for the transmission of energy at a pressure of 400 volts for the purposes of supply under the order.

Redditch.—The U.D.C. has received a report from a special sub-committee on the working of the electricity undertaking. The undertaking has never been financially successful, due, it is said, to the installation of unsuitable plant, followed later by the introduction of metal lamps and recently by the numerous strikes. The capital cost of useless plant is stated to be £10,000 out of a total of £46,000. It is proposed to pay the works manager, Mr. Ferguson, £150 in respect of his special services as consulting engineer, and in order to give the committee freedom to make any necessary charges, he has decided to terminate his engagement as works manager. The sub-committee has made 22 recommendations to the Council, including one that a works manager be appointed at £250 per annum.

Richmond.—The Richmond (Surrey) Electric Light and Power Co., Ltd., is applying for further powers, including power to take a supply in bulk from the Metropolitan District Railway Co., the London Electric Railway Co., the County of London Electric Supply Co., Ltd., and any local authority, &c.

Romford.—The U.D.C. has provisionally agreed with the County of London Electric Supply Co.'s scheme for electric supply for the district, but the sealing of the agreement has been deferred until certain clauses are definitely decided upon.

Siam.—According to the *Indian Textile Journal*, La Compagnie Mutuelle de Tramways, of Brussels, is negotiating the formation of a large new company to undertake the establishment of an electricity station in Bangkok for the supply of current for lighting and power purposes, and for tramway operations in the Siamese capital.

Stalybridge.—The Joint Tramway and Electricity Board has approved a recommendation of the Generating Station Committee to amend an application to the L.G.B. for further borrowing powers from £20,000 to £22,554.

Stoke-on-Trent.—The B.C. has applied to the L.G.B. for a loan of £8,000 for extensions of the electric light mains to Fenton.

Truro.—The T.C. has received an intimation that the B. of T. proposes to grant the application of the Corporation for a prov. order for electric lighting.

Walthamstow.—Subject to the sanction of the B. of T. the Council has decided to undertake to supply Woodford with electricity in detail. When application is made for a prov. order, the Board is to be asked to provide in such order that the repayment of capital be deferred for a period of three years from date of borrowing, interest only being paid during such period.

West Bromwich.—The L.G.B. has sanctioned the borrowing of £6,500 for extensions of electric mains, repayment being spread over 20 years.

Yarmouth.—The electrical engineer is to make an experiment on certain tramway centre poles with 200-C.P. incandescent lamps placed at each end of the bracket arm, with the view of improving the lighting of the Marine Parade.

TRAMWAY and RAILWAY NOTES.

Argentina.—Messrs. Otto Franke & Co., concessionaires for an electric railway between La Plata and the Federal capital advised the Department of Engineers of the Province of Buenos Ayres that they had commenced work, and, at the same time, they protested against that Department for the difficulties placed in their way. An investigation was ordered, and it is stated that the protest was only a pretext on the part of the concessionaires to endeavour to delay the concession being declared lapsed.—*Review of the River Plate.*

Blackpool.—The receipts from the Corporation tramways for the year which ended on Monday were £9,200 in advance of the previous year, and the statement made to this effect by Alderman Brodie at the meeting of the T.C. on Tuesday, was received with much satisfaction.

Chile.—Negotiations are being entered into to enable the Government to purchase the land on either side of the Rio Laja so as to make use of the water for a hydro-electric station to supply current for the third and fourth sections of the railway which are to be electrified, and also to supply electric light to several cities.—*Review of the River Plate.*

Continental Notes.—Belgium.—La Société des Tramways Liegeois has secured a concession for extensions of its electric tramway system, which will give connections between the southern portion of Liége and Chenée and Vaux-sous-Chevremon.

Germany.—The Local Government Board of Hirschberg has accorded permission for the construction of a new mountain railway in the Riesengeburge. The railway will be about 17 miles in length, and will run from Schmiedeberg through Steinseiffen Krummhübel, with a branch from there to Bruckenberg-Arnsdorf, Seidorf, Giersdorf, and Hermsdorf, so that a direct connection will be established between the eastern and western end of the mountains. The contract for the line has been secured by the Allgemeine Electricitäts Gesellschaft, of Berlin.

The system of working with single-phase current at 15,000 volts and 16⅔ cycles on the Dessau-Bitterfeld line is now adopted for the Madgeburg, Leipzig and Halle section. Three sub-stations are erected at Wahren, Marke and Gommern respectively each equipped with four 1,500-KW. transformers. The chief station at Muldenstein contains 16 boilers, and four 3,300-KW. turbo-dynamos. Four boilers, a turbo-dynamo, transformers, and switchboard form a complete power unit. The switchboard building is separate from the engine-room. For the working of the Prussian State railways, there have been ordered 72 new locomotives.—*Der Elektrotechniker.*

Italy.—In consequence of the results obtained from the installation of electric traction on the old Giovi line, the Ministry of Public Works has proposed to the State Railways Administration the conversion of the branch lines from Giovi to Sampierdarena and Ronco. The plans have already been settled, and the cost is estimated at about £210,000. The current for working, unlike that for the old line, will be supplied by a private company, and a contract to this end has, in fact, been signed with the Società Forze Idrauliche della Maira. Construction and equipment will be carried out under the direct supervision of the Railway Department and the line is expected to be completed by March, 1914.—*Giornale dei Lavori Pubblici.*

A 60-years' concession for the construction and working of an electric tramway between Naples and Acerra, a distance of 8½ miles, has lately been granted.

Russia.—The Ministerial Commission for the Study of New Railways is about to examine two schemes for electric lines starting from St. Petersburg. One scheme, the author of which is Mr. C. Hefding, proposes to construct a double-track normal-gauge electric railway as far as the Finnish frontier; it will have a 10-minute service, is for passengers and goods (principally wood), and will derive its energy from a fall on the River Vouoksa. Its cost is estimated at 2,969,000 roubles, and an 80-year concession is asked for. The second scheme, put forward by Messrs. Lipsky & Bieloff, proposes to construct a double-track normal-gauge railway, 17 km. long, as far as Ioukki, and a second line, 19 km., from Vossnessensky to St. Petersburg. The cost of the first line is estimated at 1,928,000 roubles and of the second at 2,007,000 roubles.—*La Lumière Electrique.*

Dundee.—The Tramways Committee of the T.C. has unanimously agreed to fix the ½d. stages on the Corporation's tramway system at a uniform length of 950 yards. A small Committee has been formed to decide upon the stages.

East London Railway.—On this line, now electrically worked, the electrical train service was started on Monday last. The service is maintained by Metropolitan trains, while the District Railway supplies the power required through its Whitechapel sub-station and a new sub-station at Surrey Docks, the latter equipped with three 300-KW. Westinghouse rotaries and transforming plant. The steam pumping stations at Rotherhithe and Surrey Docks have been converted for electrical pumping, and a special system of automatic signalling has been installed by the McKenzie, Holland, and Westinghouse Co., which utilises alternating-current track circuits. In the tunnel signals the red and green lamps are lighted by 5 and 50-volt lamps respectively, thus safeguarding the possibility of a "clear" signal being given in place of the "danger" signal.

Halifax.—A recommendation has been made that the Mount Tabor motor-bus service be extended to Wainstalls.

A request having been made that the tramway be extended from the terminus at Skircoat Green along the new road to Dudmell Lane, the Committee has passed a resolution regretting its inability to accede to the request, as it has no power to carry out the suggested extension.

Liverpool.—The report of the Corporation tramways for the year ended December, 1912, which has just been issued, shows that the total revenue for the year was £668,220. After apportioning the gross profit, the amount of net profit for the year is £133,857, an increase of £19,125 over 1911. The contribution in relief of the rates is £28,684 in excess of the amount handed over in 1911. There was an increase in the traffic receipts of £29,901. The City Council will consider a notice of motion, in the name of Councillor Holt, which reads:—"That it be an instruction to the Tramways and Electric Power and Lighting Committee to consider the practibility of utilising the tramway systems for the conveyance of goods to neighbouring towns."

At a meeting, which the public were invited to attend, held in the Picton Hall, Liverpool, last Friday evening, to protest against what was described as "a tramcar scandal," a resolution was

carried, emphatically protesting against the prevention of a free discussion in the City Council, and calling for the publication of the reports of the tramways manager and the engineering experts on the condition of the cars. One speaker observed that Liverpool was one of the worst managed towns in the whole of Great Britain, and the majority of the members bolstered up their own interests and those of private enterprises to the detriment of the public interest. Another speaker declared that there was in the City Council a conspiracy of silence to prevent the public from knowing the condition of the cars.

Middlesex C.C. and Its Passengers.—The County Council has agreed, provided certain necessary approvals are obtained, that "while no dogs or other animal" shall be allowed inside a car, they can, at the conductor's discretion, travel on top, "but must be carried up the stairs." We quote the *Times*, which concludes its paragraph with the statement: "Dogs or other animals must be accompanied by a passenger." We trust that our canine and other friends will take note, and that the ladies will not claim a monopoly of the inside accommodation.

Oldham.—The past year has been a record one for receipts, number of passengers carried, and the diminution of working expenses, according to a statement made by Mr. Isherwood (chairman of the Oldham Tramways Committee) last week. The total receipts for the year ended March 24th were £107,083, as compared with £100,364 for the previous year, an increase of £6,719. The profit on the year's working was £4,500, and considering that the wages increase during the year added £1,400 to that item, the result, in Mr. Isherwood's view, was very good. The Committee would be able to wipe out the previous year's loss of £2,413, and have a balance of £2,087. He suggested that the balance should be placed to a reserve renewal account, and mentioned that during the next few years the track would require a good deal of repairing and renewal. During the year, 104,603 more miles had been ran than in the preceding year, but they had used 106,153 fewer units, and the resultant saving was £663. The saving was accounted for by the overhauling of cars and equipment.

Plymouth.—Up to March 15th the total income from the tramways for the current financial year amounted to £38,223, and the expenditure to £35,662, compared with £37,651 and £35,139 respectively.

Stalybridge.—The Joint Tramway and Electricity Board has decided that 14 additional cars be fitted with the Spencer mechanical slipper brake.

U.S.A.—According to the *Electrical World*, the electrified zone of the New York, New Haven and Hartford Railroad is expected to be in operation to New Haven some time in May. This will more than double the railroad's present electrified trackage, which extends from New York City to Stamford. The New Haven will then have about 35 miles under electrical operation, including, besides the single-phase equipment, 12 miles of third-rail terminal tracks entering the Park Avenue tunnel and Grand Central Station. Several miles of overhead construction yet remain to be completed on the new Stamford-New Haven extension.

A run of 310 miles was made last month by a new Edison-Beach battery car, from New York to Boston. The car was 50 ft. long, and weighed 34½ tons; its equipment included four 20-H.P. 220-volt motors, and two batteries each of 230 cells. The car ran the first 114 miles (level) at an average speed of 35 miles an hour, and on an energy consumption of 37½ watt-hours per ton-mile. Subsequently a hilly route was followed; the batteries were recharged once, and subsequently received a short boost.

TELEGRAPH and TELEPHONE NOTES.

British Wireless Stations.—It has been decided to construct small-power stations at Barbados, Mombasa, Penang, Singapore and Hong-Kong. It is understood that, subject to the necessary guarantees, the work will be given to the Anglo-French Wireless Co., the English branch of the Goldschmidt Co.

France.—For the first time wireless communication was established on March 28th between the Eiffel Tower and the station at Arlington, near Washington, U.S.A. The power of the Eiffel Tower station is to be increased from 35 to 140 KW.

Imperial Wireless System.—On Thursday last week the Select Committee of the House of Commons on the Marconi contract resumed the examination of the Attorney-General, who gave further evidence with regard to his purchase of shares in the American Marconi Co. He stated that his brother Harry convinced him that the shares were likely to prove a good investment, and said that he considered the American company's prospects to be unaffected by anything that might happen to the English company. He did not refer to his dealings in American shares in his statement to the House of Commons on October 11th, 1912, because he wished to deal solely with the rumour that he and other Ministers had made large profits out of the rise in Marconi shares before March, 1912, when the contract was accepted. He had informed the Prime Minister in August of his purchase. He would not agree that his sale of 8,000 shares could possibly have been the origin of the rumours which had been published.

The examination of Sir Rufus Isaacs was concluded on Friday. The Committee resolved not to permit him to answer the question whether he had made any communication to any member of the Committee of the fact that he had purchased shares in the American Marconi Co. He stated that in addition to the shares which Mr. Lloyd George obtained from him, part of which he had sold, Mr. George had bought on May 22nd a further batch of 3,000 American shares on his own account, and that of the Master of Elibank.

Mr. Lloyd George afterwards gave evidence. He said he took little part in the negotiations for the contract, having his hands full in other ways, but was prepared to defend the contract, for which he took full responsibility. He was on terms of intimate friendship with the Attorney-General and the Master of Elibank, and it was for that reason that he took part in the purchase of American Marconi shares, on the assurance of Sir Rufus Isaacs that the American company had no interest in any contracts between the British company and the British Government. He then confirmed the statements of the Attorney-General regarding the purchase of shares, and said that the net result was that he still held 1,643 shares, and had lost at present prices about £500. It was not true that he had made large sums by speculation. He purchased the Marconi shares on April 17th because he thought they were a good investment. On April 20th he sold 1,000 shares (for himself and the Master of Elibank). The shares were resold before they were delivered.

On Monday the examination of Mr. Lloyd George was concluded, dealing mainly with points of minute detail. He said that apart from the transactions described, he had had no dealings in Marconi shares. The Postmaster-General afterwards made a statement confirming his evidence in the case against *Le Matin*. The Committee sat again on Wednesday.

In the course of his statement on the Naval Estimates last week, Mr. Winston Churchill said that the development of wireless telegraphy in seagoing ships and in the shore stations of the Admiralty had during the year been very satisfactory. Good progress had been made, and the immense utility of wireless fully justified the considerable sum spent last year and the still more considerable sum included in the Estimates for this year. In one respect, however, Admiralty interests had suffered a grave and, to some extent, irreparable loss. The delay in ratifying the Marconi agreement, and the consequent prevention of all progress in the Imperial chain of wireless stations, had deprived us of the advantages in regard to wave length and priority which we had hoped to gain through being first in the field, and now that the company had refused to carry out the contract, and since it was manifestly impossible to compel them to do so, new arrangements of a different character would have to be devised, and it was possible that additional charges would be incurred by the public. No step, however, which would now be taken could put us back into the position which had been lost.

Rural Telephones.—In answer to a question, Captain Norton stated in the House of Commons that about 900 agreements for rural party lines had been accepted, and by the end of February about 450 subscribers were using the service. Proposals under consideration would provide for approximately 500 more subscribers. Some delay had arisen recently in dealing with applications for such lines owing to the necessity for applying to the Treasury for authority to exceed the experimental grant of £10,000.

The Telephone Transfer.—Replying to a question, the Postmaster-General stated that about 80 members of the electrical staff transferred from the National Telephone Co., out of a total of over 1,300, had resigned from the service since the transfer.

Thefts from Call-Boxes.—In consequence of thefts from cash boxes in public telephone call offices in Birmingham, the authorities invented an apparatus which caused a bell to ring when the lid of the cash box was opened. By this means a man named Charles Pollett was captured last week, and he was committed for trial.

United States.—The report of the New York Telephone Co., for the year 1912, on the combined operating results of the company and its associated companies, shows total telephone earnings $65,632,688, telephone expenses $18,461,690.75, net telephone earnings $17,170,999.77; add other income $1,510,072·57, making total net earnings $18,681,170.34. After deducting interest charges and dividends declared a balance of $5,492,161.77 is carried as surplus and reserves. Including the associated connecting companies, there were in service in the whole system at the end of the year 1,756,343 stations, an increase of 232,319 stations.

Arrangements are being made between the American and Russian Governments for the establishment of a regular wireless service across Behring Sea, which will ensure telegraphic communication between America and Asia at all times, even in the event of interruption of the cable service. The project, it is said, taken in connection with the existing trans-Atlantic radio service, completes the circuit of the globe by this means of communication.—*Journal of Electricity, Power and Gas.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

Victoria.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices". March 28th.

April 15th.—1,020,000 arc lamp carbons, 26,900 carbon-filament incandescent lamps, and bare hard-drawn copper cables, for the Melbourne City Council. See "Official Notices" March 28th.

Sydney.—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard.*

Tasmania.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

Queensland.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" to-day.

Ayr.—Corporation tramways. Tenders for work in connection with Hawk Hill extension—permanent way construction, road widening, &c. Mr. J. Young, engineer, Town Buildings, Ayr.

Blackpool.—High and low-tension cables and transformer switch pillars. See "Official Notices" March 14th.

Bradford.—April 17th. Three-phase and continuous current switchgear for two sub-stations, for the Corporation. See "Official Notices" to-day.

Buenos Ayres.—April 15th. Supply of motors, cables, dynamos and other accessories for motive power. Oficina de la Direccion General de Minas, Geologia e Hidrologia, Buenos Ayres.

Chorley.—Board of Guardians. Tenders for a complete telephone installation for the workhouse.

Dundee.—The Corporation electricity department invites tenders for the supply of steel sashes and frames, and for the supply and erection of opening casements, for extensions at Carolina Port generating station. Mr. H. Richardson, general manager and engineer.

Edinburgh.—Electric lighting for the new Veterinary College buildings at Summerhall. Mr. D. M'Arthy, architect, 25, Frederick Street, Edinburgh. Deposit two guineas, returnable.

France.—Paris.—The Administration des Chemins de Fer de l'Etat invites tenders for the supply of three electrical traversers. Particulars, 43, Rue de Rome, Paris.

Germany.—Hanover.—April 15th. Tenders are invited for the supply of the plant in eight lots for the hydroelectric station in the Eder Valley, comprising two 3,000-H.P. double-spiral Francis turbines and two 1,550-H.P. ditto, with governors, &c., turbine piping, four 6,000-volt three-phase generators, two rotary converters and a storage battery, three 6,000-KW. oil transformers for 6,000/55,000 volts, transmission lines, two 25-ton hand cranes of 25 metres radius, and a completely fitted switchboard. Particulars and drawings of all the items save the switchboard may be obtained on application enclosing 15 marks (for the switchboard 20 marks) to the Königlichen Maschinenbau Amt, Hannover, Brandstrasse, 1.

Glamorgan.—April 10th. Electric plant, wiring, &c., for the Training College now erecting at Barry for the Glamorgan County Council. Plans, &c., to be seen at office of the Clerk to the Council, at the Glamorgan County Hall, Cardiff.

Glasgow.—The Tramways Sub-Committee on Works and Stores of the T.C. is inviting offers required under the annual contracts. Mr. James Dalrymple, general manager, Headquarters, Bath Street.

Keighley.—(*a*) Foundation work for a 2,000-KW. turbo-alternator and condensing plant at the electricity works; (*b*) rolled steel joists in connection with the above. Drawings and specifications obtainable from Mr. H. Webber, Borough Electrical Engineer, Coney Lane, Keighley.

Leyton.—Tenders are to be invited for meters, and for one mile of ·2 and ½ mile each of ·025 and ·0125 cable, for the Council.

The Education Committee invites tenders for wiring the Church Road school extension.

Limerick.—April 10th. Stores and materials for a year, for the Borough electricity department. See "Official Notices" March 28th.

Lisnaskea (Co. Fermanagh).—April 14th. Gas engine and suction gas plant, dynamo and booster, battery, wood poles, overhead mains, &c., and switchboard, for the Lisnaskea Electric Light Co., Ltd. See "Official Notices" March 28th.

London.—L.C.C.—April 15th. Electrical installation at Jeffryes' Almshouses, Shoreditch. See "Official Notices" to-day.

April 23rd.—Electrical installation at Shadwell High Street Special School. See "Official Notices" to-day.

Fulham.—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" to-day.

Manchester.—April 15th. Tramways Committee. Tenders for roofing-over of avenues at the Hyde Road car works, Manchester. Mr. J. M. McElroy, General Manager.

April 15th.—(*a*) Tramway rail bonds; (*b*) Hard-drawn copper trolley wire; (*c*) Steel tramway poles; (*d*) Span drive brackets for tramway poles; (*e*) Granite setts. Mr. J. M. McElroy, General Manager. For (*c*) and (*d*) a deposit of £1 1s. is required.

Norway.—The Norwegian Telegraph authorities in Christiania have just invited tenders for the supply of 405 tons of iron wire and 57 kilometres of steel wire and lead-covered cables, for the telegraph service.

April 11th.—76,300 kg. galvanised iron wire; 18,000 insulators and 7,000 metres of rubber-insulated copper wire, for Norwegian State Railways. Apply Telegrafinspektörens kontor, Stenersgaten, 8—IV, Christiania; also Board of Trade Com. Intel. Dept., London.

Maryborough.—April 9th. 1,120-amp.-hour accumulator, for the District Asylum. See "Official Notices" March 28th.

Salford.—April 10th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" March 28th.

Stalybridge.—4,500 yards E.H.T. three-core lead-covered cable. See "Official Notices" March 14th.

Stockton-on-Tees.—April 10th. One 200-KW. rotary converter, transformer and starting apparatus, for the Corporation. See "Official Notices" to-day.

York.—April 5th. The Board of Guardians is prepared to receive tenders for (1) a dug well round an existing bore hole, an additional cast-iron liner down the bore hole, a deep-well pump for 5,000 gallons per hour, and two small centrifugal pumps and electric motors; and (2) water-softening plant (without heat) dealing with 5,000 gallons per hour. Tenders to the Clerk (Mr. George Sykes), Union Offices, Museum Street, York.

CLOSED.

Belgium.—Five German and three Belgian concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of a large quantity of telegraph cables. For one lot the lowest tender was that of the Société A.E.G. Union Electrique, and for the second lot the Siemens and Halske Co. quoted the lowest price.

Bexhill-on-Sea.—The T.C. has renewed for a period of ten years the agreement with Tudor Accumulator Co., Ltd., for the maintenance of batteries, at £70 a year.

Bushey.—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for the installation of electric fire alarms, at £63 10s. per annum, for seven years.

France.—The French State Railway authorities in Paris have just placed a contract with La Société Alsacienne de Constructions Mecaniques de Belfort, for the supply of 1,350 metres of electric cables.

Gloucester.—The T.C. has accepted the tender of Messrs. Ruscoe, of Hyde, for mechanical stokers at the electricity works, at £195.

Haslingden.—The T.C., on March 27th, approved of the following tenders for the erection of machinery, &c., at the sub-station:—

British Thomson-Houston Co., Ltd.—Rotary converter.
Ferranti, Ltd.—Switchboard panel, recording voltmeter and charts.
Chloride Electrical Co.—Extension of tramway switchboard.
Siemens Bros.—Additional feeder cable.

Heston and Isleworth, and Belfast.—Messrs. Chamberlain & Hookham have received contracts for meters from the Councils of Heston and Isleworth and Belfast.

Hornsey.—The D.C. has decided to place a contract with Messrs. Isaria, Ltd., for electricity meters.

Ilford.—The U.D.C. has accepted the following tenders:—

Electromotors, Ltd.—Middle-wire reversible booster, £51.
Wardle Engineering Co., Ltd.—Electric light fittings for centrally lighting High Road.

The following tenders have been accepted for annual supplies:—

Main cables.—Union Cable Co.
Arc lamp carbons.—J. & H. Grevener, and Sloan Electrical Co., Ltd. ("Couradty" make).
Incandescent lamps.—Siemens Bros. Dynamo Works, Ltd., and Cryselco, Ltd.
Meters.—Ferranti, Ltd.; British Thomson-Houston Co., Ltd.; Siemens Bros. Dynamo Works, Ltd; Isaria, Ltd.
House service fuse boxes.—W. Lucy & Co., Ltd., and W. T. Henley's Telegraph Works Co., Ltd.
Joint boxes.—W. Lucy & Co., Ltd.

The following tenders have been accepted for tramway supplies:—

General Electric Co., Ltd.—Lampholders, batten holders and tapes.
R. W. Blackwell & Co.—P. and B. tapes.
Le Carbone.—Carbon brushes.
British Westinghouse Co.—Armature coils.

Kendal.—The Westmorland County Council has accepted the tender of Messrs. R. Hadwon & Son, of Kendal, for the electrical installation at the Allen Technical Institute at Kendal.

Leyton.—The U.D.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Shipley fine slack coal for the electricity works, at 13s. 10d. per ton, for a year.

Liverpool.—The tender of the Compania Fabril de Carbons Electros, per Mr. C. W. Webster, Bradford, has been accepted by the T.C. for an annual supply of flame arc lamp carbons.

London.—Lewisham.—The following tenders were before the Guardians at their meeting on Monday for electrical installation work at the Infirmary and the Workhouse :—

	Infirmary.	Workhouse.
Smeeton & Page	£1,192	£1,008
Chapman & Co.	1,800	1,800
Haycraft & Sons	875	759
Ellis & Ward, Ltd.	1,380	1,095
Alliance Electric Store, Ltd.	998	970
V. G. Middleton	1,050	1,200
A. J. Ewens	749	975
Weston & Sons	909	640
Tredegar & Co.	856	668
Watson & Co.	1,247	1,185
W. R. Reynolds, Ltd. .. .. (accepted)	479	449
A. K. Klamet	925	1,089
Stegmann & Co.	1,127	897
Cozens, Ltd.	1,249	1,010
Malcolm & Allan, Ltd.	1,505	1,804
Saville & Walton	940	797
L. Sunderland Co.	1,400	1,050

The tender of Messrs. W. R. Reynolds, of East Ham, was accepted. In the event of the firm not agreeing to carry out the contract, the Board decided that the wiring of the Infirmary should be done by Mr. A. J. Ewens, and the Workhouse by Messrs. Weston & Sons.

Fulham.—The Fulham Board of Guardians has accepted the tender of the Hart Accumulator Co., Ltd., for the supply of a storage battery of 102 cells required for the Fulham Workhouse.

Luton.—For Council. Brush Electrical Engineering Co., Ltd., two 1,000-kw. turbo-alternators and condensers, £9,200.

Maidenhead.—The T.C. has accepted the tender of the Crynant Colliery Co. for 1,000 tons of coal for the electricity works, at £1 1s. 10d. per ton.

Plymouth.—The Borough Surveyor reported to the Tramways Committee that he had communicated with four firms for the purpose of obtaining quotations for the supply of 100 tons of tramway rails. Two of the firms had declined to submit a price, being too busy, and the other two had submitted prices which were subject to acceptance within seven days. After communicating with the Chairman, and with his authority, he had accepted the tender of Messrs. Walter Scott, Ltd., at £8 10s. per ton. The surveyor's action was confirmed.

Salford.—The following tenders have been accepted by the T.C. :—

General Electric Co., Ltd.—Three rotary converters and static transformers, £6,200.
Bertram Thomas.—Extension of lighting and power switchboard at electricity station, £438; supply of extra feeder panels, if required, £54 each.

Southend-on-Sea.—The contract for poles, brackets, &c., mentioned last week, was placed with Messrs. Watlington & Co *not* Worthington & Co. as stated in our last issue.

Stalybridge.—The Joint Tramway and Electricity Board has accepted the tender of Messrs. Wm. Storrs, Sons & Co., Ltd., for the erection of a chimney at the generating station.

Traction Lamps.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract from Messrs. Balfour, Beatty & Co. for the supply of traction lamps (tantalum and Wotan) for the following tramways for 12 months : — Luton, Llanelly, Dartford, Carlisle, Leamington and Warwick, Notts and Derby.

Walthamstow.—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., at £3,478, for the supply of four additional tramcars, and the tenders of Messrs. Chamberlain & Hookham and Messrs. Ferranti for meters for the ensuing year.

Warrington.—The British Westinghouse Co., Ltd., has received an order from the T.C., for a 25-h.p. motor.

The following tenders have been accepted by the T.C. :—

Brush Electrical Engineering Co., Ltd.—Transformers.
General Electric Co., Ltd.—Direct-current motors.
British Thomson-Houston Co., Ltd.—Alternating-current motors.

Worcester.—The City Council has placed a contract with B.I. and Helsby Cables, Ltd., for cables for three years.

Wrexham.—The following tenders for the supply of materials to the electricity works have been accepted :—

Reason Manufacturing Co.—Miniature electrolytic meters.
Edison & Swan United Electric Light Co.—Carbon-filament lamps.
Jas. Light & Son, Ltd.—Crank chamber oil.
Henry Wells Oil Co.—Cylinder oil.
Wm. Hughes.—Boiler solution.
Barton & Co.—Slack.

The Committee has also accepted the following tenders :—

British Westinghouse Co.—Condenser, £160.
H. Davies.—Erection of sluice gates, £76.

Yarmouth.—The tender of Messrs. Walter Scott & Co., Ltd., has been accepted by the T.C. for 180 tons of steel tramway rails, at £8 2s. 6d., as has also the tender of Messrs. John Baker and Co. (Rotherham), Ltd., for 60 steel tires, at 34s. 6d. each.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—To-night. At 8 p.m. King's Hall, Holborn Restaurant. Last Smoker of the season.

Salford Technical and Engineering Society.—Saturday, April 5th. At 7 p.m. At the Royal Technical Institute, Salford. Paper on "Modern Gas Engines," by Mr. K. Cox.

Association of Engineers-in-Charge.—Saturday, April 5th. At 8 p.m. Visit to the works of the Westminster Electric Supply Corporation, Horseferry Road.

Wednesday, April 9th.—At 8 p.m. At St. Bride's Institute, E.C. Paper on "Notes on the Design and Economy of Diesel Oil Engines," by Capt. H. Riall Sankey.

Saturday, April 12th.—Annual Dinner.

Institution of Electrical Engineers (Scottish Section).—The annual general meeting is postponed from April 8th to April 15th.

(Newcastle Students' Section).—Monday, April 7th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Notes on the Operation of Three-Phase Transformers," by Mr. R. C. Phillip.

(Manchester Section).—Tuesday, April 8th. At 7.30 p.m. At the University, Manchester. Annual general meeting and lecture by Prof. E. Rutherford.

(Birmingham Section).—Wednesday, April 9th. Meeting at the University, Birmingham.

(Newcastle Section).—Wednesday, April 9th. At 7 p.m. At the Lit. and Phil., Middlesbrough. Paper on "Power Supply on the Rand," by Mr. A. E. Hadley. Afternoon visit to the works of the Skinningrove Iron Co.

(London).—Thusday, April 10th. At 8 p.m. "Self-Synchronising Machines," by Dr. E. Rosenberg.

(Dublin Section).—Thursday, April 10th. Meeting at 8 p.m. At the Royal College of Science, Dublin.

Society of Engineers.—Monday, April 7th. At 7.30 p.m. At the I.E.E. Paper on "The Status of Engineers and Engineering, with Special Reference to Consulting Engineers," by Mr. W. Ransom.

Royal Society of Arts.—Wednesday, April 9th. At 8 p.m. Paper on "Electricity Supply in London," by Mr. F. Bailey.

Junior Institution of Engineers.—Friday, April 11th. At 89, Victoria Street, S.W. Paper on "Methods of Regulating and controlling Working of Electric Accumulators," by Mr. G. C. Allingham.

Physical Society.—Friday, April 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "Some Errors in Magnetic Testing due to Elastic Strain," by Messrs. A. Campbell and H. C. Booth, and "Note on Cathodic Spluttering," by Dr. G. W. C. Kaye.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued :—

Monday, April 7th.—"A" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Tuesday, April 8th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, April 10th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, April 11th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, April 12th.—Headquarters will be opened for regimental business from 10 a.m. till noon.

(Signed) J. H. S. Phillips, Major.
For Officer commanding L.E.E.

NOTES.

The Electro-Harmonic Society.—To-night the last Smoking Concert of the season will be held at the Holborn Restaurant (King's Hall), commencing at 8 o'clock. The artistes are as follow : Vocalists—Mr. Henry Turnpenny (tenor), Mr. Peter Dawson (baritone) ; Humorists—Mr. Dutch Daly, Mr. Ben Osborne ; Original Character Sketches—Mr. Stacy Aumonier ; Entertainer at the Piano—Mr. Harrison Hill ; Humorous Recitations—Mr. Walter Churcher ; Banjo Solo—Mr. Olly Oakley ; Entertainer—Mr. Hewson Brown ; Piano Solo and Accompanist—Mr. Bernard Flanders, A.R.A.M.

Copper.—In the course of his speech on the difficulties of the year 1912, the chairman of the United Alkali Co., Ltd., mentioned that they had to pay about £70,000 more for coal and other articles than in the previous year, and prices had been permanently increased. The average price of copper, he said, had been about £18 per ton higher. The position for 1913 was difficult for the company as they could not raise their selling prices.

Faraday House Old Students' Association.—The Annual Dinner of this Association will be held at the Hotel Cecil (Victoria Hall), on Friday, April 11th, at 7 (for 7.30 p.m.), with the president, Mr. Haydn T. Harrison, M.I.E.E., in the chair. Any Faradians desirous of attending, who have not received a notice, are requested to communicate with the hon. secretary, F.H.O.S.A., Faraday House, Southampton Row, London, W.C.

Will.—According to the *Times*, the late Sir William H. White left estate of the gross value of £38,377, of which the net personalty has been sworn at £34,599.

I.M.E.A. Preliminary Programme.—The eighteenth annual Convention of the Incorporated Municipal Electrical Association will be held in London in June, and the following programme has been arranged tentatively :—

Tuesday, June 17th.

10.0 a.m.—Opening of the Convention at the Institution of Electrical Engineers. (1) Address by Mr. C. E. C. Shawfield, ex-President, late chief electrical engineer, Wolverhampton ; (2) Paper on "Prime Movers," by Dr. S. Z. de Ferranti, Past President I.E.E., to be followed by a discussion.

1.0 p.m.—Luncheon interval.

2.30 p.m.—Visits to the West Ham Electricity Works and works of the London Electric Supply Co., Ltd., at Deptford.

Wednesday, June 18th.

10.0 a.m.—Meeting at the Institution of Electrical Engineers. Discussion (members and delegates only). Subject to be announced.

1.0 p.m.—Luncheon interval.

2.30 p.m.—Visit to London Electric Railway Power Station, Lot's Road, Chelsea.

7.0 p.m.—Annual dinner, Hotel Cecil. Members, delegates, visitors and ladies.

Thursday, June 19th.

10.0 a.m.—Special train from Waterloo.

11.0 a.m.—Meeting at the Empire Theatre, Kingston-upon-Thames. (1) Paper on "Electric Vehicles," by Mr. A. H. Seabrook, member of Council, and Messrs. W. Watson, and R. J. Mitchell. (2) Paper on "Air Filtration," by Mr. J. Christie, Past President, chief electrical engineer, Brighton.

1.30 p.m.—Luncheon interval.

3.0 p.m.—River trip to Walton and Hampton Court, &c.

Friday, June 20th.

10.0 a.m.—Meeting at the Institution of Electrical Engineers. (1) Annual general meeting to receive the Council's annual report and the auditor's report and balance-sheet, elect the officers and Council, and transact other business. (2) Special general meeting to revise the articles of association.

Saturday, June 21st.

10.0 a.m.—It is hoped that it may be possible to arrange for a visit to the Metropolitan Water Board's new pumping plant at Chingford.

The headquarters of the Association will be the Hotel Cecil, and members are advised to book their rooms there or elsewhere at once, as it will be difficult to obtain accommodation later. The attendance of ladies accompanying members and delegates will be welcomed at the annual dinner and the visit to Kingston. An official programme will be issued in due course, and in the meantime all communications should be addressed to Mr. C. McArthur Butler, 28, Bedford Square, London, W.C.

Manchester Electro-Harmonic Society.—The closing concert of the first season of this Society was held last Friday evening. There was an attendance of something like 120, and the meeting was under the chairmanship of Mr. Sells. We hear that the musical items were exceptionally well received, notably the singing of "The Erl King," by Mr. Bridge Peters. Mr. F. S. Sells, in the course of a vote of thanks to the President, Mr. Pearce, remarked that the Society was exceptionally fortunate in having a gentleman of Mr. Pearce's standing as its president, who, notwithstanding that he was an exceptionally busy man, had taken great interest in the Society. Another notable point was that the Society, which only started in October last with a membership of 70, had now increased that membership to 170. Mr. Sells made an earnest appeal to each of the members to endeavour to get at least two new members, and it is hoped that the Society will commence next season with at least 300 members. A vote of thanks was proposed by Alderman Walker (vice-chairman of the Electricity Committee) and seconded by Mr. William Cramp, to the musical director, Mr. W. J. Smith, the secretary, and the treasurer. Each of these gentlemen responded, and a successful season was brought to a close with "Auld Lang Syne."

Parliamentary.—Safety Lamps.—Sir Fred. Cawley asked the Home Secretary whether he had done anything to meet the complaints of safety-lamp manufacturers that they were charged a high fee for having lamps tested, whilst for testing lamps in Germany, France and Austria there was no charge, and that the testing station was not accessible and caused inconvenience ; and whether he would say under what statute the Government had power to levy fees for testing safety lamps. Mr. McKenna said it had been found possible, in view of the large number of lamps which the makers proposed to submit, to make substantial reductions in the fees as originally fixed. The fees were so fixed as merely to cover the expenditure actually incurred in connection with the testing of a lamp, and no statutory authority was required for charging the fees. The testing station was established at Eskmeals because the Home Office already had an experimental station there, and the work could be carried out more economically for the makers as well as more conveniently for the Department than if the Home Office had had to acquire a special site and appoint a special staff. It might be possible later on to make arrangements for its transfer to a more central spot.

Tramway Accident Claim.—A settlement has been effected in the Court of Session action by a Renfrew teacher against the Paisley District Tramway Co., for £500 damages. Pursuer alleged that a tree which interfered with defenders' overhead wires was being cut down, and that she was struck on the head by a falling branch. Defenders denied fault. They made a payment of £50 and expenses, and the action has now been taken out of Court.

Annual Dinners and Socials.—London.—One of those fixtures which we have always the greatest pleasure in attending is the annual staff dinner of the Osram and Robertson Lamp Works, which was again held in the Coronation Hall, Clarendon Restaurant, Hammersmith, on Friday, March 28th. In the unfortunate absence, through illness, of Mr. Hirst, the chair was genially filled by Mr. C. Wilson, ably supported by Messrs. Sheppard and Driver, while Mr. Gosling looked after the general welfare of the visitors, among whom we noticed Mr. Jack Fletcher, manager of the lamp sales department of the G.E.C. ; Mr. Scolding, of Messrs. W. Cory & Sons ; Councillor Johnson, of the Hammersmith Electric Light Committee ; Councillor Cook, and other well-known local gentlemen, the company mustering about 90 in all. After the usual loyal toasts given by the chairman, Mr. F. P. Driver proposed "The Allied Firms," to which Mr. Wilson responded, expressing his regret at the absence of Mr. Hirst, and referring to the steady progress of the firms, whose *personnel* had increased from a total of 90 to a present total of 1,700, which, when the extensions now in progress were completed, would shortly be increased to 2,000. He was delighted to say that, throughout the works, there was a complete absence of friction and in every department a loyal striving for success. He also made the announcement that the directors had provided the necessary funds for the establishment of a club house, and he hoped, on the next occasion, to welcome their guests in their own house. The company then settled themselves to enjoy an excellent programme, provided, with one exception, by the members of the staff. Liszt's Rhapsodie Hongroise No. 2 was excellently played by Mr. E. C. Hosier, while Miss Dallender sang delightfully to her own accompaniment, besides taking part with Mr. J. Minson in a short farce. Mr. E G. Sheppard proposed the health of "The Visitors and the Press," coupling it with the names of Mr. Scolding, Mr. Jack Fletcher and Mr. Sydney Rentell, who suitably responded. Mr. Fletcher, who was, according to Mr. Sheppard, suffering from "Osramitis" (a strange disease whose symptoms are more noticeable among competitors than with the actual sufferer) pointed out that the year's sales had far exceeded any previous year, and that it was a subject of congratulation that this increase was not due to one or two exceptionally large contracts, but to a general expansion of the field of operations. The toast of "The Chairman," proposed by Mr. P. Pring, was received most heartily, and Mr. Wilson responded, calling the attention of those present to memories of the growth of the concern.

Barnsley.—The staff of the Corporation Electricity Works held their first annual dance in the Arcadian Restaurant, Barnsley, on Thursday evening last week, when nearly 200 people were present.

Electricity Supply Rifle League.—A representative match was shot on Saturday last between a team chosen from the above League and the London and South-Western Railway Rifle Club, on the latter's range at Clapham Junction. The scores were as follows :—

L.S.W.R.—H. Baker, 97 ; F. J. C. Mercer, 97 ; G. E. Barnes, 95 ; G. Coffin, 95 ; J. Cole, 95 ; W. Colley, 95 ; R. A. Hazeldine, 95 ; F. R. Wilson, 93 ; total, 762 ; E. Gray, 91 ; C. I. Barnes, 89.

E.S.R.L.—H. Mugford, 97 ; E. Neville, 97 ; J. K. Wells, 97 ; F. Winchcombe, 97 ; W. J. D. Partridge, 95 ; F. Barber, 93 ; A. W. Law, 93 ; E. G. Furneaux, 92 ; total, 761 ; H. P. Gaze, 91 ; H. A. Pearman, 91.

As the match was 10 to shoot and 8 to count, the result was a win for the railwaymen by the smallest possible margin, viz., one point, but on the total for all 10 men the electricians were one point to the good. After the match both teams were entertained to high tea by the general manager of the L.S.W.R. It is hoped to have a return match very soon.

A Surveyor's "Loan."—*Lloyd's Newspaper* reports a matter which was before the Sittingbourne County Court, on Saturday last, in which Mr. W. Richmond Warlow, surveyor to Milton Regis Urban Council, sued Mr. C. D. Richardson, an electrical engineer, and formerly member of the Whitstable Urban Council, for £20, money alleged to have been lent.

"In 1911 Mr. Warlow entered a competition for the best plan for sewage works at Whitstable. This scheme was accepted, and afterwards he became on friendly terms with Mr. Richardson. The latter, he said, asked him to lend him some money, and he sent Mr. Richardson two cheques for £10 each. Whitstable Council objected to the site of the proposed works, and ultimately Mr. Warlow's scheme was not taken up. When the plaintiff wrote for repayment of the loan defendant ignored his letters. Mr. Richardson said he did not ask for a loan. The money was a gift for services rendered in connection with the acceptance of the sewage scheme. Defendant's wife corroborated his account. Judge Shortt said he was convinced that the money was given by Mr. Warlow with the corrupt and illegal intention of influencing the conduct and vote of the defendant as a member of the Whitstable Urban Council in respect of Mr. Warlow's sewage scheme, and that it was accepted by Mr. Richardson with a knowledge of plaintiff's intention. The amount could not be recovered. Judgment was entered for the defendant."

Imperial Services Exhibition.—A preliminary prospectus has been issued regarding the above exhibition, which is to take place at Earl's Court from May onwards this year. The object of the Exhibition is to show the great advance that has taken place in late years in the scientific preparation for the defence of the Empire by land and by sea. The exhibits will include examples of transport, field cooking, signalling and wireless telegraph equipments. The Empress Hall will be converted into a lake, and electrically-driven models of Dreadnoughts, cruisers, and torpedo boats will manœuvre thereon. Wireless telegraph and signal stations will be at work.

Association of Electrical Station Engineers.—A meeting was held at Birmingham, on Thursday last week, for the purpose of forming a branch of the A.E.S.E. for the Birmingham district. After some discussion, it was resolved not to appoint a Committee at that meeting, but that the secretary be asked to obtain by correspondence and reference to the register of the Association a representative Committee, and that another meeting be called to elect the Committee. All those present promised to make application for membership, and to endeavour to get others to make application. For the time being the affairs of the A.E.S.E. for Birmingham and district are in the charge of Mr. E. A. Gordon, 41, Spencer Avenue, Coventry.

A meeting was held at Grimsby on Friday last for the purpose of forming a branch of the Association. Fourteen gentlemen were present. The meeting was opened by the reading of a letter from the hon. secretary (Mr. Ebben), and, after the aims and objects of the A.E.S.E. had been freely discussed, it was unanimously resolved that a branch be formed for Grimsby and district. A Committee of six gentlemen was appointed, with Mr. W. M. Fowler as hon. secretary. It was decided to hold another general meeting to-day (Friday) to enable those who were on shift during the above meeting to attend.

Accident.—Mr. George Widlake, chief electrical engineer at the Coxside works of Plymouth and Stonehouse Gas Co. met with a nasty accident on Saturday. He was engaged in cleaning a revolver at a bench in the works, when by some means the weapon was discharged and the bullet struck him, grazing a lower rib. He was removed to the South Devon and East Cornwall Hospital, where he is doing well.

Inquiries.—A correspondent asks if there is any system of wiring for private houses, which is the permanent property of the tenant and does not become landlord's fixtures. Another correspondent asks for names of makers of small portable power-driven air pumps, capable of producing a vacuum down to about ·001 mm. The present makers of the "Niblett" solid accumulator are asked for.

Appointments Vacant.—Correspondence clerk, for the Swindon Corporation Electricity and Tramways Departments (£70); installation inspector and tester, for the Birkenhead Corporation Electricity Department (£104); mechanic, for the Science Departments of the University College of North Wales, Bangor (30s.); assistant engineer, for the Burgh Electricity Works, Hamilton (£125). See our advertisement pages in this issue.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following are the nominations for election to the Council for 1913-14 :—

The names in italics are those of the persons nominated by the Council for the vacancies which will occur on September 30th, 1913. Others remain in office.

President.—*W. Duddell, F.R.S.*

Vice-Presidents (two vacancies).—*Hon. Sir C. A. Parsons, K.C.B., F.R.S., J. F. C. Snell*, W. Judd, C. H. Merz.

Honorary Treasurer.—*R. Hammond.*

Ordinary Members of Council.—Members (one vacancy).—*A. L. C. Fell* and *G. Scott Ram*, F. Gill, J. S. Highfield, H. Hirst, B. M. Jenkin, J. E. Kingsbury, Dr. A. Russell, W. Rutherford, A. H. Seabrook, Roger T. Smith, C. P. Sparks, H. E. Wimperis.

Associate Members (three vacancies). — *F. E. Berry, Captain E. O. Henrici, R.E., A. W. Martin, S. W. Melsom.*

Associates (two vacancies). — *E. Russell Clarke, Francis Ince, A. M. J. Ogilvie, C.B.*, A. B. Anderson.

(Manchester Section).—A meeting of the Section was held on the 1st inst., when a paper was read by Dr. E. Rosenberg on "Self-Synchronising Machines." An interesting discussion followed, to which the author replied. The annual meeting of the Section will be held next Tuesday, when a lecture will be given by Dr. E. Rutherford on "The Electrical State of the Atmosphere."

Physical Society.—At the meeting held on March 14th, 1913, a paper on "Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits," was read by Dr. J. A. Fleming, F.R.S. The author gave a very short method, involving only the simplest algebra, for arriving at a formula for the time of free electrical oscillation of a leaky condenser in series with an inductive resistance, the oscillations being damped. Oscillograms taken at low frequency with a Duddell oscillograph were shown, demonstrating the accordance of fact with deductions from the formula. In the same manner the case of coupled circuits was considered, and Dr. Fleming deduced an equation, which showed that there were, in general, oscillations of three frequencies in the circuits. This was confirmed by photographs of oscillograms and diagrams of resonance curves.

A second paper by Dr. Fleming described some Braun cathode ray tubes used as high-frequency oscillographs, and an electrostatic influence machine giving a steady current of 300 to 350 microamperes for working them.

Prize Competition for a Miner's Electric Safety Lamp.—The Verein für die bergbaulichen Interessen im Oberbergamtsbejirk Dortmund are offering an award of £1,250 for a miner's electric safety lamp possessing the following advantages :—Unprovocative of explosions, even after having received a blow or damage; useable for 12 hours uninterruptedly; easy to carry, not cumbersome, strong, simple to control, economical; furnished with a gas indicator, like the ordinary oil or benzine lamp; and of a lighting power of 1 hefner after 12 hours' burning. Lamps must be sent in, with explanations in German and drawings, before October 1st, 1915.

Electricity Works in the Argentine Republic.—In a leaderette in this issue we refer to the rapid development in Argentina. The following list of cities and towns in which electric light stations exist or for which concessions have been obtained or contracts are pending, has been compiled by the *Review of the River Plate*, and is of some interest in connection with the above :—La Plata, C. de Patagones, Chivilcoy, Dolores, Pergamino, Necochea, Carmen de Areco, Luján, Bahia Blanca, Punta Alta, San Fernando, General Alvear, Coronel Vidal, Campana, Navarro, 24 de Mayo, Saladillo, Chascomús, General Belgrano, Las Flores, Dolores, Azul, Olavarria, La Madrid, Coronel Suarez, Pigué, Concordia, Florencio Varela, Mercedes, Dorrego, Tres Arroyos, Mar del Plata, Balcarce, San Martin, Tandil, Ayacucho, Maipú, Pringles, Suipacha, Bragado, Avellaneda, Lomas, Trenque Lauquen, City of Buenos Ayres, Corrientes, Goya, Monte Caseros, Curuzú, Cuatiá, Posadas, Paraná, Victoria, Concepcion, Gualeguay, Gualeguaychú, Catamarca, Rioja, San Juan, San Luis, Villa Mercedes, Mendoza, Salta, Santiago del Estero, La Banda, Jujuy, Tucuman, Cordoba, Villa Maria, San Francisco, Bell Ville, Sufino, Santa Fe, Rosario, Coronda, Galvez, Rafaela, Esperanza, Reconquista, San Carlos Centro, Caseros (Buenos Ayres), San Rafael, Pélotas, Colon, General Paz, Capilla del Monte, San Antonio Oeste, San Andres de Giles, 9 de Julio, Trelew (Chubut), Laboulaye (Cordoba), Nogoya, San Justo, Venado Tuerto, Vera (Santa Fe), San Lorenzo, General Villegas, Villa Nueva, San Cristobal, Junin, Merlo, Carcarañia (Santa Fe), General Pico, General Sarmiento, San Martin de los Andes, Alberdi, Cruz (Cordoba), Ramos Mejia, Villa Ballester.

India.—A demonstration of certain sources of weakness said to be common to nearly all forms of block instruments at present in use on Indian railways was recently given, at Delhi, by Mr. McCloskey, assistant electrical engineer, B., B. and C.I.R., before a Committee of senior Government Inspectors, representing the Railway Board. Experiments were shown illustrating irregularities in block working by which the Ghaziabad disaster, and many subsequent collisions and potential collisions, may have been caused. Arrangements have been made to give an extensive practical trial to the safeguards suggested.—*Indian Engineering.*

First Aid in Case of Electrical Burns.—A commission, representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers, suggests the following rules as embodying the approved methods for first care of electrical burns :—

"A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off; cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0·5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil such as machine oil, transformer oil, vaseline, linseed, carron or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs or other soft cloth, held lightly in place by a bandage.

"The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

"Do not open blisters."—*Electrical World.*

Electric Cooking : Australian Development.—We have it on the authority of the *Australian Mining Standard* that remarkable demonstrations have lately taken place in Melbourne of a new system of electric heating and cooking which "allows such economy in current consumption and gives such rapid heating effects that the stove suitable for the average householder, fitted with the new unit heated to 600° within 7½ minutes, turned out a batch of perfectly cooked scones within 17 minutes of the current being applied." Our contemporary mentions the great simplicity of its construction, and says that "the cheapness of manufacture of the elements will enable the owners of the patents to manufacture at such low costs that a full-sized electrical stove can be sold to the householder at a price approximately that of the ordinary gas stove, and full electrical appliances at similarly low figures. The cost of cooking will be reduced by between 50 and 75 per cent. below any other apparatus at present on the market." We shall await fuller particulars with no little interest.

Fatalities.—Alex. Faulds, a Vale of Leven man, in the employment of the Dominion Power Transmission Co., Hamilton, Ontario, was recently killed instantly by receiving a 4,000-volt shock while working on a transformer.

A correspondent says that a young man named Herbert Allen, aged 19, an electrical fitter of Nottingham, was killed at the transforming station at Ushaw Moor Colliery, Durham, on Monday.

Correction.—On page 552, in the last paragraph of the article on the "Fixation of Atmospheric Nitrogen," it is stated that 1 KW. should suffice to "fix" 100 kg. of nitrogen per annum, but that in practice little over 400 kg. are obtained; these figures should be 1,000 and 4,000 respectively.

Killed by Lightning.—At an inquest held at Reigate on Mrs. Charlotte Oxley, according to a son's evidence, the deceased was preparing for church when there was a flash of lightning; witness heard a fall, and found his mother on the floor. Dr. Watson said there were no external marks, but an examination revealed several bruises on the skull bone, small hæmorrhages on the surface of the brain, and a larger one at the base. The lightning must have caused death, the current passing through deceased without injuring the skin. A verdict in accordance with the medical testimony was returned.

The Aberdeen Slander Action.—A correspondent says that it is understood that the action raised by Mr. James Alexander Bell, electrical engineer of the City of Aberdeen, against Mr. Alfred Edward Milne, solicitor, Aberdeen, hon. secretary of the Aberdeen branch of the Electrical Contractors' Association of Scotland, for £1,000 damages for alleged slander, will come up for proof in the Court of Session on June 24th. Lord Hunter recently adjusted the issues for trial by jury.

Alleged Fraud.—The charge against H. G. Ménage, an electrical engineer, reported in our last issue, was before the Marlborough Street Police Court again the other day, when, according to the *Morning Advertiser*, it was urged by counsel in defence that there was no case against his client, as by the terms of the agreement the defendant was a partner in the firm. He contended it was not a *bonâ fide* prosecution. Mr. Denman thought it was a case for a jury to decide. He would express no opinion on its merits. Mr. Lewis said the defendant bore an irreproachable character, and he submitted that no jury would convict. Mr. Denman committed the prisoner for trial, allowing bail in the sum of £30.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On Sunday, March 30th, the staff of the Wolverhampton Corporation electricity department met at the Commercial Road Works to wish farewell to the retiring chief, MR. C. E. C. SHAWFIELD. After being photographed, the party moved to one of the offices, where Mr. Shawfield was presented with a solid silver salver, suitably inscribed, which had been bought by subscriptions from the whole of the staff. Speeches were made by several members of the staff, who wished Mr. Shawfield every success in his new undertaking, and expressed their great regret at losing him. More than one speaker said that the only fault he had to find with Mr. Shawfield as chief, was that he had been unable to use the profits of the undertaking to bring salaries and wages up to a reasonable level, rather than to hand them over for the relief of rates. In reply, Mr. Shawfield thanked those present for their kind appreciation, and said that he and Mrs. Shawfield, who had always taken the keenest interest in the work of the department and in the staff, would consider the salver one of their most treasured possessions, not only for its intrinsic value, but chiefly for the good feeling which prompted the gift. He referred to the development of the department since its commencement, and gave accounts of amusing incidents which occurred in its early days. He expressed the opinion that it was to be regretted that any money had been paid over to the relief of the rates, as he thought it was not in the best interests of the department, or the town as a whole, that the profits of a trading undertaking should be used for this purpose. He thought that the first call on the profits of the undertaking should be to improve the status of employment, as the success or otherwise of the department depended, to a very large extent, on the efforts of those employed therein; any surplus beyond this should go to reducing the price of current to the consumers. However, Mr. Shawfield said that the chief of a department had not a free hand in the matter of salaries and wages, but that he, in turn, had to carry out the instructions of his employers — the municipality. He also imparted the information that he would not be leaving the town—at any rate, for a few years—and thus hoped still to keep in touch with those with whom he had been associated for so long a period.

Out of 134 applicants, MR. R. B. LEACH, electrical engineer to the Turton District Council, has been appointed electrical engineer and tramways manager to the Heywood Corporation, at £200 per annum.

We regret to learn that MR. A. A. DAY, borough electrical engineer, Bolton, who has been staying at the Cleveley's Hydro, Blackpool, had another seizure last week end. His medical adviser was summoned, and Mr. Day's condition caused considerable anxiety. Mr. Day was seized with sudden illness whilst in the train at the beginning of last September, when he was commencing his holidays, and he has not been himself since.

MR. J. E. STARKIE, Burnley's electrical engineer, is suffering from a nervous breakdown, and has been advised to spend some time at St. Anne's.

Through a mishap at the Accrington generating station on March 27th, MR. ERNEST HALL, charge engineer, sustained serious injuries. The cause of the accident is not known, but Mr. Hall was found in a sluice in connection with the gas generating plant. He was taken to hospital, where it was discovered that he had badly injured his head and fractured an arm.

MR. W. G. COATH, who has been on the staff of the Newton Abbot Electricity Works for the past 3½ years, was on Friday last presented with a handsome case of instruments by members of the staff, on the occasion of his departure to Swindon. The presentation was made by the resident engineer, Mr. G. E. Smith.

MR. THOMAS D'ARCY NASSAU, who is at present resident engineer to the Honiton and District Electric Supply Co., Ltd., has been appointed resident engineer and manager to the County of Dorset Electric Supply Co., Ltd.

At a special meeting of the Lowestoft Town Council on Tuesday, MR. W. R. MAY, who has been assistant engineer at the Corporation Electricity Works for 10 years, was appointed borough electrical engineer (in the place of Mr. G. A. Bruce resigned), at a salary of £250 a year, rising to £280 by annual increments of £10. MR. H. H. SAUNDERS, chief accountant in the Borough Tramways Department, was appointed general manager of the electric light and tramways undertakings, at a salary of £220 a year, increasing to £250 by increments of £10 per annum.

MR. R. H. LEE has resigned his position of junior engineer at the Fulham Electricity Works, in order to take up the post of junior shift engineer at the Borough of Islington Electricity Works.

General.—MR. E. P. BENNETT has been transferred from the sales department of the London office of Simplex Conduits, Ltd., to take up the position of manager at their Liverpool branch.

MR. EDWARD ALFRED GIMINGHAM, M.I.E.E., and MR. CHARLES ERNEST HUNTER, the works managers of the lamp and engineering departments respectively of the Edison & Swan United Electric Light Co., Ltd., have been elected to seats on the board of the company.

MR. J. P. MEIKLEJOHN, who has been works manager with Messrs. Grindlay, Ross & Co., of Glasgow, has been appointed chief assistant engineer to the Penarth Electric Lighting Co., Ltd.

The marriage took place last week at Bargoed of MR. T. S. THOMAS, electrical engineer, of Ystradgynlais, and Miss Mabel Clement, daughter of Mr. H. Clement, of Bargoed.

MR. G. GILKES, of Messrs. G. Gilkes & Son, turbine makers, of Kendal, has been re-elected an alderman of Westmorland County Council.

The marriage took place on March 27th at Wellingborough of MR. THOMAS JAMES LARGE, electrical engineer, of the staff of Messrs. Belliss & Morcom, of Birmingham, and Miss Jessie Gadsby, youngest daughter of Mr. W. K. Gadsby, of Brigstock.

MR. WATSON, of Messrs. W. G. Watson & Co., Ltd., Sydney, will be in England, Europe, and the United States, toward the middle of the year in connection with the opening up of a London office of the company.

MR. A. B. SCORER has joined the board of Messrs. Meldrums, Ltd., who have moved their London office to 92, Grosvenor Road, Westminster, S.W.

MR. HERBERT LAWS WEBB has removed from 35, Old Queen Street, S.W., to 104, Victoria Street, Westminster, S.W.

Congratulations and good wishes to MR. and MRS. LEONARD G. TATE. The marriage of the secretary of the Electrical Contractors Association was to take place at Richmond Parish Church yesterday. We regret having to mingle our congratulations with condolences, for we read in the *Electrical Contractor* that Mr. Tate's mother passed away a few days ago.

Obituary.—MR. J. PARKER.—The death occurred suddenly, at Blackpool, on Saturday, of Mr. John Parker, who had had a long connection with the firm of E. Green & Co., Ltd., engineers, of Manchester and Wakefield. He was in his 76th year.

MR. G. HUMPHREY.—The death is announced, at the age of 65 years, of Mr. Geo. Humphrey, head of the firm of Geo. Humphrey and Co., electrical and general engineers, of High Street, Sevenoaks.

NEW COMPANIES REGISTERED.

Rio Grandense Light and Power Syndicate, Ltd. (127,781).—Registered March 14th, by S. Morse, 1, Kingsway, W.C. Capital £100,000 in £1 shares. Objects: To carry on the business of suppliers of electricity, gas for lighting, heating, motive or other power, &c., in Brazil and elsewhere, to adopt agreements (1) with Emilie Guilayn giving an option of purchase of the electric light undertaking in the town of Bage, State of Rio Grande de Sul, Brazil; (2) an agreement with Buxton, Cassini & Co. for sale and purchase of a concession for the exploitation of electric tramways, power and light service in the City of Pelotas, in the said State; (3) an agreement with the British Electric Traction Co., Ltd., appointing them the company's London agents; and (4) with Buxton, Cassini & Co., appointing them the company's local agents in Pelotas. The signatories (with one share each) are:—Emilie Guilayn, Salisbury House, E.C., banker; T. Bower, Electrical Federation Offices, 1, Kingsway W.C., secretary. Private company. The directors are to number not less than three or more than five. The Articles of Association specify that the first directors shall be Senor Emilie Guilayn and one to be nominated by the British Electric Traction Co., Ltd. A copy of register of directors filed at same time names Senor Guilayn and Charles H. Dade (of 1, Kingsway W.C.) as the directors. Registered office, Electrical Federation Offices, 1, Kingsway, W.C.

Barton-on-Humber Electric Supply Co., Ltd. (127,760).—This company was registered on March 14th, with a capital of £20,000, in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with F. Hopper. The subscribers (with 100 shares each) are:—F. Hopper, Elm Tree House, Barton-on-Humber, cycle manufacturer; J. B. Tombleson, Westfield, Barton-on-Humber, brick and tile manufacturer; H. Wilson, The Hall, Barton-on-Humber, solicitor; H. Pigott, Eagle House, Barton-on-Humber, managing director; J. Barraclough, Westfield Road, Barton-on-Humber, shipowner; W. H. Blyth, Highfield, Barton-on-Humber, brick and tile manufacturer; J. C. Lee, George Street, Barton-on-Humber, pharmacist. Minimum cash subscription, £3,000; the number of directors is not to be less than three or more than seven; the first are F. Hopper, J. B. Tombleson, H. Wilson, H. Pigott, J. Barraclough and W. H. Blyth; qualification, £100; remuneration as fixed by the company. Solicitors, Nowell & Son, Barton-on-Humber. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Reform Lighting Co., Ltd. (127,914).—This company was registered on March 20th, with a capital of £3,000 in £1 shares, to take over the business of electric lamp manufacturers carried on as the "Reform Lighting Co." The subscribers (with one share each) are:—G. W. Lemax, 35, Moore Street, W., clerk; P. Rowson, 14, Harcourt Street, Marylebone, W. clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Pakeman, Son & Read, 11, Ironmonger Lane, E.C.

Frank Tomey & Co., Ltd. (127,769).—This company was registered on March 14th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of and dealers in glass, glass tubing, electric lamps, Röntgen ray and glass bulbs, &c., to acquire the business carried on by F. S. Tomey & J. Kent at the Borough Glass Works, Victoria Road, Aston, Birmingham, and at 66, Hatton Garden, E.C., as Frank Tomey & Co. The subscribers (with one share each) are:—F. S. Tomey, 140, Victoria Road, Aston, Birmingham, manufacturer; J. Kent, Kenmore, Green Lane, Palmer's Green, manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are F. S. Tomey (permanent managing director) and J. Kent; remuneration, £14 each per month. Solicitors, Botteley & Sharp, 104, Colmore Row, Birmingham. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Southern Brazil Electric Co., Ltd. (£187,856).—Registered March 18th, by Linklater & Co., 8, Bond Court, Walbrook, E.C. Capital £1,000,000 in £1 shares. Objects: To acquire shares, debentures, and other securities of any interests or participations in any companies, corporations, or firms carrying on tramway, light and power, waterworks, sewage and drainage construction business, or the business of carrying out local improvements or any of such businesses, or similar thereto, in Brazil or elsewhere, to carry on business as electrical and hydraulic engineers, &c., and to adopt agreements (1) with A. J. Byington and (2) with the Parana Power Syndicate, Ltd. (vendors) for the acquisition of shares, properties, businesses and rights referred to therein. The signatories (with one share each) are:—R. A. Fellowes, 1, Cornhill, E.C., stockbroker; F. E. O. Tootal, 1, Cornhill, E.C., stockbroker; H. Philips, 1, Cornhill, E.C., clerk; D. J. Pirie, 1, Cornhill, E.C., clerk; E. Fisk, Lothfield, Tadworth, Surrey, clerk; G. Barnard, 48, Carringham Road, Golder's Green, N.W., clerk; T. F. Lyon, 21, Rumney Road, Brixton, clerk. Minimum cash subscription seven shares. The directors are to number not less than two nor more than ten. A letter addressed to the Registrar says "that no directors have yet been appointed nor have any persons yet consented to act," but the articles of association state that the first directors of the company are all nominees of the vendor syndicate or directors or shareholders thereof or otherwise interested therein. The directors are authorised to pay to the said A. J. Byington the cash purchase price payable to him under the terms of the said agreement with him and to allot to him or his nominees the 600,000 fully-paid shares of £1 each, which are to be allotted under the terms thereof, and to pay to the vendor syndicate the cash purchase price payable to them under the terms of the agreement with their syndicate, and in addition to allot to the syndicate, or its nominees, the 399,993 fully-paid shares of £1 each, which are to be allotted pursuant to the terms of the said agreement. Remuneration as fixed by the company.

Electric Zinc Co., Ltd. (127,838).—Registered March 18th, by Burchells, 5, The Sanctuary, Westminster. Capital £3,000,000 in £1 shares (400,000 preference). Objects: To acquire, work, and exercise patents, inventions, and secret, or other processes for the extraction of zinc and other metals from their ores, slimes, or other compounds by the application of electricity or otherwise, to grant licences in respect thereof; to carry on the business of electricians, electrical and mechanical engineers, and contractors, suppliers of electricity, contractors of and dealers in all kinds of apparatus and things required for or capable of being used in connection with the generation, distribution, supply, accumulation, and employment of electricity, winners and workers of electricity, miners, smelters, mining chemists, dealers in minerals, plant, and machinery, &c. The signatories (with one share each) are:—J. A. Braik, 20, Cambridge Road, Wimb'edon, accountant; W. A. French, 171, Carlingford Road, Tottenham, N., cashier; A. E. Lambert, 32, Blenheim Gardens, Wallington, solicitor; C. Vince, Croydon, Elm Park Gardens, Barnes, S.W., clerk; C. Hendy, 5, Marney Road, Clapham Common, S.W., clerk; E. G. Robinson, 18, Thornhill Square, Barnsbury, N., clerk; D. A. Dennis, 8, Lucerne Road, Thornton Heath, clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than 10) are to be appointed by the signatories, and shall be entitled to remain in office until the close of the ordinary general meeting for the year 1916; qualification (except first directors, who require none), £250; remuneration (except managing directors) not less than £303 each per annum (chairman £200 extra). The preference shares shall confer the right to a fixed cumulative preferential dividend at the rate of 7 per cent. per annum on the capital paid thereon. Subject to the rights of the said preference shares to such dividend, the holders of the ordinary shares shall be entitled to be paid out of the surplus profits of each year available for dividend, divided at the rate of 7 per cent. per annum for that year on the amount credited as paid up on the ordinary shares held by them respectively. The residue of the surplus profits of each year available for dividend, shall belong to and be divided among the holders of the preference and ordinary shares proportionately. Registered office, 5, The Sanctuary, Westminster.

Eastern Electric Co., Ltd. (127,767).—This company was registered on March 14th, with a capital of £2,000 in £1 shares, to take over the business of electrical dealers and manufacturers, carried on as the Eastern Electric Co., and to adopt an agreement with C. E. H. Walter and C. Midworth. The subscribers (with one share each) are:—C. E. H. Walter, 11, Queen Victoria Street, E.C., civil engineer; C. Midworth, 11, Queen Victoria Street, E.C., electrical engineer. Private company. The first directors are C. E. H. Walter and C. Midworth (both permanent). Registered office, 11, Queen Victoria Street, E.C.

"Der" Trading Syndicate, Ltd. (127,871).—This company was registered on March 19th, with a capital of £1,000 in £1 shares, to deal in electric light and other lamps and globes, wires and other accessories and fittings; to manufacture electric and other clocks, accumulators, &c., and to adopt an agreement with J. R. Gault. The subscribers (with one share each) are:—A. E. Derry, 217, King's Road, Chelsea, S.W., gentleman; J. R. Gault, 148, Fellowes Road, Hampstead, N.W., gentleman; Dr. S. G. Rumschiysky, 117, Clifton Hill, N.W. Private company. The number of directors is not to be less than two or more than five; the first are A. E. Derry, J. R. Gault, and Dr. S. G. Rumschiysky. Registered by Shepheards & Walters, 23, Young Street, Kensington, W.

Shipston Electrical Co., Ltd. (128,010).—This company was registered on March 28th, with a capital of £3,500 in £1 shares (1,500 preference), to take over the business of an electricity supply works carried on at Camden Road, Shipston-on-Stour, Worcestershire. The subscribers (with 10 shares each) are:—F. E. Brown, 63, Parade, Leamington Spa, electrical engineer; J. M. Herman, 10, Rosefield Street, Leamington Spa, engineer. Private company. The first directors are F. E. Brown (permanent) and F. Jonas, with power to appoint one other before the general meeting in 1914; qualification, £150. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Chalmers, Ltd. (8,590).—This company was registered in Edinburgh on March 25th, with a capital of £2,000 in £1 shares, to carry on the business of electrical engineers and manufacturers. The subscribers (with one share each) are:—E. H. A. Bostock, 5, Burnbank Terrace, Glasgow, theatrical manager; A. Campbell, Kilmory, Kilmacolm, solicitor. Private company. The number of directors is not to be less than two or more than five: the first are E. H. A. Bostock and A. Campbell; qualification, £1. Registered office, 113, West Regent Street, Glasgow.

Headcorn and Maidstone Light Railway Co., Ltd. (128,000).—This company was registered on March 28th, with a capital of £10,000 in £1 shares, to construct, work and maintain a railway, light railway, tramway, tramroad or other permanent or semi-permanent way from Headcorn to Maidstone, Kent. The subscribers are:—F. G. Langham, 44a, Robertson Street, Hastings, solicitor, 1 share; W. G. Scott, Sandrock, Athelstan Road, Hastings, clerk, 1 share; E. H. Langham, 44a, Robertson Street, Hastings, solicitor, 1 share; H. F. Stephens, Salford Terrace, Tonbridge, civil engineer, 100 shares; W. A. Wardle, 6, Pump Court, Temple, E.C., barrister, 100 shares; A. E. Strick, 172, Athelstan Road, Hastings, clerk, 1 share; A. E. Wilkes, 2, Lorne Villas, Harold Road, Hastings, clerk, 1 share. Minimum cash subscription, £100. The first directors, to number not less than three or more than five, are F. G. Langham, H. F. Stephens and W. A. Wardle; remuneration, £10 each per annum. Registered office, Salford Terrace, Tonbridge.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

London and Suburban Traction Co., Ltd.—Trust deed, dated February 25th, 1913, to secure £550,000 4½ per cent. first mortgage debenture stock, charged on £61,731 fully paid £1 5 per cent. cumulative preference and 492,827 fully paid £1 ordinary shares in Metropolitan Electric Tramways, Ltd.; 72,884 fully paid £10 5 per cent. cumulative preference and 96,534 fully paid £10 ordinary shares in London United Tramways Ltd.; 200,000 £1 shares (1s. per share paid) in the Tramway (M.E.T.) Omnibus Co., Ltd., and all further shares (if any) of any class in such companies acquired within three months. Trustees: Parr's Bank, Ltd., 4, Bartholomew Lane, E.C.

Electric Ozone Syndicate, Ltd.—Capital, £12,000 in £10 shares; return dated November 19th, 1912 (filed January 8th, 1913); all shares taken up; £11,930 paid, leaving £70 in arrears. Mortgages and charges: £9,572 16s. 5d.

Central Electric Supply Co., Ltd.—Capital, £100,000 in £5 shares; return dated February 18th, 1913 (filed February 25th); all shares taken up; £100,000 paid. Mortgages and charges: £450,000 4 per cent. guaranteed debenture stock.

Lamp Manufacturing Co., Ltd.—Capital, £10,000 in £1 shares; return dated February 16th, 1913 (filed February 21st); 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debentures.

Melbourne Electric Supply Co., Ltd.—Trust deed, dated March 7th, 1913, to secure 5 per cent. debenture stock for an amount not exceeding £500,000 or the amount of the issued share capital for the time being, whichever is greater, charged on company's undertaking, and assets, present and future, subject to first mortgage debenture stock, except uncalled or unissued capital and sums placed to dividend equalisation account. Trustees, Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Adelaide Development Co., Ltd. (64,393).—Capital, £42,500 in £10 shares. Return dated December 31st, 1912. All shares taken up. £10 per share called up on 3,700 and £3 on 220 shares. £37,750 paid. £3,000 considered as paid on 300 shares. Mortgages and charges: Nil.

Rangoon Electric Tramway and Supply Co., Ltd.—A memorandum of satisfaction, the extent of £5,466 on March 18th, 1913, of debenture stock dated February 1st, 1906, and December 22nd, 1908, securing £250,000, has been filed.

South London Electric Supply Corporation, Ltd.—Issue on March 4th, of £300 debentures, and on March 18th, 1913, of £600 debentures, parts of a series of which particulars have already been filed.

Fraser & Chalmers, Ltd.—A memorandum of satisfaction on various dates from March 21st, 1912, to February 20th, 1913, of debentures for £22,100, in respect of which a statement under Sec. 12 of the Companies' Act, 1907, was filed on October 8th, 1908, part of a series of £350,000 6 per cent. debentures, secured by a mortgage dated June 30th, 1898, has been filed.

S. Bornett & Co., Ltd. (89,565).—Capital, £2,000 in £1 shares (1,000 pref.). Return dated March 10th, 1913. 950 ord. and 757 pref. shares taken up. £1 per share called up on 757 pref. and £1 5s. on 200 ord. £1,007 paid. £750 considered as paid on 750 ord. shares. Mortgages and charges: Nil.

St. James' and Pall Mall Electric Light Co., Ltd. (26,015).—Capital, £300,000 in £5 shares (20,000 pref.). Return dated March 4th, 1913. All shares taken up. £5 per share called up on 39,650 ord. and 20,000 pref. £298,250 paid. £1,750 considered as paid on 350 ord. Mortgages and charges: £150,000 5½ per cent. deb. stock. £125,000 4 per cent. guaranteed deb. stock of the Central Electric Supply Co., Ltd., being half the total loan capital.

National Electric Engineering Co., Ltd. (62,605).—Capital, £5,000 in £1 shares. Return dated December 31st, 1912: 2,659 shares taken up; £654 paid; £2,005 considered as paid. Mortgages and charges: Nil.

Walsall Electrical Co., Ltd.—Mortgage on freehold property, Nos. 57-63, Bridge Street, Walsall, &c., dated March 7th, 1913, to secure all moneys due or to become due from the company to London City and Midland Bank, Ltd.

CITY NOTES.

Rhondda Tramways Co., Ltd.

THE annual meeting of this company was held at the offices, 3, Laurence Pountney Hill, E.C., on March 13th, Mr. L. B. Schlesinger presiding. Our reporter was informed that the meeting was private, but he was subsequently granted permission to see the chairman's speech. This showed that after providing for interest on debentures and loan, redemption of debentures, rent of the Rhondda U.D.C., and depreciation, there was a balance of £2,778 on the year's working, plus £1,198 brought forward. Out of this, £2,000 had been added to the reserve and renewals account, bringing it up to £10,000, and leaving £1,976 to be carried forward. During the coal strike their receipts dropped from between £900 and £1,000 per week to as low as £594, and the weekly receipts following the termination of the strike were £736, £832, £971, £947 and £1,064, but, unfortunately, just before Whitsuntide their own employés were smitten with the strike fever, and put forward extraordinary demands in the form of an ultimatum, which demands, however, after careful consideration by the directors, it was decided could not, in the interests of the shareholders and the future welfare of the company, be entertained. The undertaking was closed down for about a month, but no damage was done to the company's property, and as events turned out, the directors' action was fully justified. At the request of the chairman of the Rural Council, who had been approached by the men, Mr. Cownie was asked to meet the men's committee at Porth, and this he did, with the result that on the following day the strike was at an end, the men returning to work on the old terms. As 25 new hands had in the meantime been taken on, 25 of the old hands had to stand down

although within a short time the manager was able to offer them employment. Unfortunately, however, as the strike occurred just before Whitsuntide, one of their biggest weeks, the company was hit pretty heavily; for instance, during Whitsuntide week they certainly looked to take receipts up to about £2,000, but they only ran one day, and their receipts were £108. Although the undertaking was closed down, a considerable portion of their expenditure still ran on, and he thought the directors were on the safe side in stating in the report that the profits suffered to the extent of £6,500 owing to the coal strike and the strike of their employés. It was mentioned in the report that the receipts for the six months to December 31st last amounted to £30,000, as compared with £19,700 for the previous six months. The extensions which were opened helped the receipts, and judging from the results already obtained, the original traffic estimates from the extensions would be thoroughly justified, and he would not be surprised if this year their traffic revenue exceeded £60,000, provided no further labour troubles were experienced. He thought, however, that both masters and men had had enough of these disputes, and that every effort would be made to keep the peace. The directors, however, did not represent philanthropists, but investors, who naturally looked for a fair return upon their capital. Although further debentures to the amount of £40,000 were only issued in November, 1912, and interest on them paid from that date, he could point out that until then they financed the construction of the extensions by loan from the bank, on which interest had to be paid. The report referred to a Bill which was being promoted to construct a railless traction system to serve a very important colliery district within a few miles of their terminus at Williamstown. There were some 16 pits being sunk, and it was estimated that within the course of a few years the population to be served would have increased from approximately 14,000 to over 50,000. They were asked by the manager of the collieries in question to provide travelling facilities for the miners, and, after studying the scheme, they came to the conclusion that if powers could be obtained on reasonable terms, the scheme would be a profitable one for the company, and would bring considerable extra traffic over the tramways. The capital account now stood at £364,200, an increase of £35,581. The discount on debentures issued to cover the cost of the extensions had been added to the account, and after deducting the debentures redeemed, the amount was £21,400, compared with £19,800 for last year. To-day they had at the bank and on loan £15,000, so that as regarded finance the company was in a strong position. Turning to the revenue account proper, comparison with the revenue account for 1911 was impossible, having regard to the troubles already referred to. The speaker referred to a number of items. Traffic expenses amounted to £9,953, as compared with £10,315, the decrease being due to the strike. General expenses amounted to £7,336, compared with £6,786, a small increase. Repairs and maintenance amounted to £4,889, as compared with £4,226, the increase being largely due to repairs on cars, which were overhauled and repainted. Traffic revenue was £49,778, an increase of £1,561, which was very gratifying under the circumstances. While the results must be unsatisfactory to the shareholders, they were satisfactory to the directors, considering the troublous experiences of the year, which no foresight on their part, or on the part of the management, could have prevented. A word of praise was due to the manager, Mr. Nesbitt, for the manner in which he had handled the business throughout the year, and particularly during the strike. The thanks of the shareholders were due to Mr. Barnett for his numerous visits to Rhondda on behalf of the board. It was, of course, a great regret to the directors that they were unable to recommend a dividend, but a careful study of the results, together with the opinions that he had been able to give them, could only lead to one conclusion, viz., that they had in the Rhondda Tramways a valuable undertaking with great potentialities, and all that was wanted to obtain a satisfactory return upon their capital, was peace in the labour world. Their traffic receipts from January 1st to March 12th were £11,004, as compared with £9,163, or an increase of £1,841.

Mr. J. T. Jervis seconded the motion, which was adopted.

Browett, Lindley & Co., Ltd.—According to the *Financial News*, the gross profit for 1912 was £5 253. After deducting £2,191 for bank and debenture interest, and £5,019 for depreciation, there remains a loss on the year's working of £1,965, making, with the former adverse balance, a present debit to profit and loss of £17,562. The adverse trading is attributed to low prices for contracts, the continuous rise in the cost of materials, increased wages, and the coal strike. The directors state that the orders now on the books are at better prices. The preference dividend remains unpaid since December, 1901.

Oriental Telephone and Electric Co., Ltd.—At the annual meeting on 30th inst. (subject to final audit) the directors will recommend the following dividends:—At the rate of 6 per cent. per annum on the preference shares for the half year ended December, less income-tax; a final dividend of 7 per cent. on the ordinary shares issued, free of income-tax, making a total of 10 per cent. for the year. The share transfer books will be closed from April 17th to 30th, inclusive.

Continental Note.—Switzerland.—La Société d'Electricité Alioth, of Basle, which has a working arrangement with Messrs. Brown, Boveri & Co., of Baden, is declaring a dividend of 4½ per cent. for the last financial year, the same as for the preceding 12 months.

Arbroath Electric Light and Power Co., Ltd.

At the fifth annual meeting, held on Friday, Mr. George Balfour presided. The report showed that the profit for the year amounted to £1,740, plus £856 brought forward, while £470 had to be deducted for interest, leaving a balance of £2,126. The directors proposed to apply to reserve and renewal funds £500; for dividend at 5 per cent. on preference shares, £18; in payment of dividend of 3 per cent. on ordinary shares, £685; and to carry forward £922, subject to deduction of directors' and auditors' fees. The general business of the company was steadily extending, and there had lately been a large and increasing demand for power. In view of this, the directors had resolved to enlarge the plant at the electric station, and the additions would be carried out during the course of the present year.

Mr. Balfour referred to the increase in capital from £30,000 to £40,000, which had been divided into 15,000 preference shares and 25,000 ordinary shares. He pointed out that with the issue of preference shares there was no likelihood of it ever being necessary to issue debentures, as the preference shares would provide, approximately, the amount required for repaying existing loans, and providing for increasing the plant capacity at the power station by approximately 130 per cent. of the existing plant. The directors had resolved during the coming summer to install additional generating plant. Power-users in this country had only recently wakened up to the great advantage of electricity for power purposes, and this was particularly noticeable in Arbroath, as the company had secured the leading engineering and manufacturing firms as consumers for driving the whole of their works. The prospects of the company were exceedingly bright, and but for the increased price of coal, which materially affected costs during 1912, the results shown, excellent as they were, would have been still better.

The motion adopting the report and accounts, and declaring a dividend of 3 per cent. on the ordinary shares was unanimously carried.

Provincial Cinematograph Theatres, Ltd.—This company held its annual meeting on Tuesday at the Holborn Restaurant. The report showed receipts from theatres for the year amounting to £198,702, and the trading profit £80,355, an increase of £33,250 over 1911. After providing for debenture interest and redemption, preferred dividend, depreciation, writing off preliminary expenses, and issue of preference shares, and carrying £5,000 to reserve, the ordinary dividend is 20 per cent., and there is a bonus of 4 per cent. upon debentures. The company is going to issue 200,000 7½ per cent. cumulative "B" preference shares of £1 each for redeeming the debentures and extending the business, including the erection of new theatres in Edinburgh, Portsmouth, Newcastle and elsewhere, and the enlargement of existing ones.

Braunton Electric Light and Power Co., Ltd.—The first annual report of the directors congratulated the shareholders upon the success attained. The net revenue account showed a profit of £81, and the directors recommended payment of a dividend of 5 per cent. (less income-tax) on the cumulative preference shares from October 1st, 1911, which would amount to £29, writing £30 off the formation expenses, and carrying forward £21. Mr. T. Yeo, C.C. (chairman of directors), who presided, said the capital authorised to be raised was 5,000 £1 shares, divided into 1,000 5 per cent. cumulative preference shares, and 4,000 ordinary shares, each of £1, and the amount of capital issued totalled £3,250 of fully paid shares. That, he said, was found not quite sufficient for the whole matter, but the directors did not feel there was any necessity for the calling up of extra capital, thinking it better to raise a certain amount out of revenue account. So far as they could see, their present machinery, equipment and capital in hand, would be sufficient. He moved the adoption of the accounts, and observed they had good reason to be gratified at the first year's results. The report was adopted.

Wemyss and District Tramways Co.—Mr. Geo. Balfour, of Balfour, Beattie & Co., moved the adoption of the report at the annual general meeting on Saturday. He intimated that it was the intention of the directors to double the line by degrees until the whole service was lined up. Councillor Barrow, Leven, who seconded, drew attention to the congestion which existed in the service, and also asked when the electric cable would be laid through Leven. Mr. Balfour said he was afraid they could do nothing with the congestion until the whole line was doubled and double-decked cars were run. The report was adopted.

Newmarket Electric Light Co., Ltd.—Mr. F. E. Gripper presided at the annual meeting of this company, and said that the revenue had increased during the year by £300, and the expenses by £158. The coal bill had advanced by £95. The report was adopted.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ending March 31st, 1913, payable April 28th.

Lancashire Dynamo and Motor Co., Ltd.—The *Financier* states that the directors have declared a dividend at the rate of 10 per cent. on the ordinary shares, making 7½ per cent. for the year, placing £6,000 to reserve fund, and carrying forward £1,631.

Folkestone Electricity Supply Co., Ltd.

The annual meeting was held on Thursday last week. Alderman Spurgen, J.P., who presided, in moving the adoption of the report, said they had had a very fair year's work. There had been an increase in the receipts of £1,417, and if that had stood alone they would have had a good year. It was, however, neutralised by the fact of the increased cost of £1,873, which put them £456 on the debit side. The increased cost of coal owing to the strike had been £1,128. As he told them last year, the mine-owners, owing to the unrest of the miners, were cautious about entering into contracts, and, unfortunately, they were caught just at a bad time, and their coal worked out at 3s. 4½d. per ton more than in the previous year; but they had made a saving in the amount of coal per unit. They were looking forward to the time when the Kent coalfields were developed and when they would be able to get a supply in their own neighbourhood. Personally, he was very hopeful that, in another 18 months, they would get their supply from the Kent coalfields. Rates and taxes had also increased considerably, and the national taxes, with the National Insurance Act, represented an increase of £246. They had, however, written off £6,073 on depreciation account, and that fund now stood at £28,573, and in addition to that they had carried £4,100 to reserve fund. Shareholders might say that £28,000 depreciation fund was very large. All their plant in active use was in excellent order, but new machinery was constantly being brought out, and they might find it imperative some day to get rid of some of the present machines and introduce others of a newer type. They had had a good year so far as new lamps were concerned. They had put in 7,104, as against 6,100 last year, and they had 189 more consumers. There were no bank charges, as they had a deposit of over £10,000, and altogether things looked very hopeful. He moved the adoption of the report and that a dividend of 6 per cent. be paid for the half-year, making 6 per cent. for the whole year, less income-tax.

Alderman Penfold seconded, and it was carried.

Tynemouth and District Electric Traction Co., Ltd.

Mr. H. S. Day presided on 26th ult. at the Electrical Federation Offices, Kingsway, W.C., over the annual meeting of this company.

The Chairman, in moving the adoption of the report, said that the total revenue for the year amounted to £13,661, a decrease of £508 compared with 1911, and after deducting all expenses chargeable to revenue, including £1,000 for renewals, and writing off a loss of £278 on the sale of consols, there remained a surplus on the year's working of £4,377, which, with £551 brought forward from last account, made an available balance of £4,929. The directors had placed £1,250 to reserve, and recommended a dividend of 5 per cent. on the cumulative preference shares and 4 per cent. on the ordinary shares, and that £297 be carried forward. With the sum recommended this year the renewals and reserve funds of the company would amount to £19,502. Trade during the year at Tynemouth was very unsettled, owing to the coal strike in the first portion of the period, and the strike of railway men on the North-Eastern Railway later, but a better condition of affairs now existed, and he thought the present year would show an expansion of the improvement. He was pleased to say that so far their net position this year compared most favourably with the same period of 1912. They had carried 1,992,000 passengers during the year, as compared with 2,093,000 in 1911, a decrease of 101,000. This decrease was entirely due to the bad weather experienced during the summer. The average traffic receipts per passenger, 1·53d., remained the same, chiefly due to the increased fares put in force during the year, whilst the average expenditure per passenger, ·87d., also remained the same. The proportion of expenses to receipts, 56 per cent., remained the same, whilst the number of car-miles run had decreased by 3,379. The negotiations with the Tyneside Corporation for an extension of the line to Preston Village was still proceeding, and it was hoped that satisfactory terms would be arranged for carrying out the work of construction. The junction formed with the Tyneside Tramways and Tramroads Co. with the tramways of the Tynemouth Co. in North Shields for the purpose of improving the interchange of traffic between the two companies had proved satisfactory.

Mr. S. J. Somerville seconded the motion, and the report was adopted without discussion.

American Telephone and Telegraph Co.—The directors' report for 1912, which has appeared in the financial papers in abstract during the past week, shows that the net earnings were $37,907,644, an increase of $4,606,398 over 1911. The interest charges were $5,844,699, and the dividends, at the regular rate of 8 per cent. per annum, were $26,015,588. Of the balance, $6,047,357, there was carried to reserve $2,800,000, and to surplus $3,247,357. During the year $13,652,000 of new stock was issued under the offer of June 20th, 1911. In addition, $2,726,200 of stock was issued upon conversion of bonds, making the total increase of capital stock during 1912 $16,378,200. At the close of business December 31st, 1912, $132,998,000 of the $150,000,000 of convertible bonds of 1906 had been handed in for conversion, leaving outstanding at the end of the year $17,002,000, a reduction in 1912 of $3,457,000. The number of shareholders, 50,297, on December 31st, 1912, shows an increase of 2,956 during the year. As to the future of the company, the board state it was never brighter.

Berlin Elevated and Underground Railway.

The report of the Gesellschaft für Elektrische Hoch und Untergrundbahnen, of Berlin, for 1912, states that the extensions in progress, according to the programme, were so far advanced in the year that the prospective opening to traffic of the northern section from the Spittelmarkt, *viâ* the Alexander Platz to the Schönhauser Allee, will take place in May, and the south-western sections from Wittenberg Platz to the Nurnberger Platz, and to the Kurfürstendamm, in September of the present year. By means of these prolongations the length of the railway will be increased from 11 miles to 15·8 miles, and that of all the lines operated by the company from 12·7 miles to 22 miles, including the level railway and the communal lines to be connected with the Nurnberger Platz station. The complementary line from the "triangle" station to the Wittenberg Platz will re-establish direct connection between the Eastern line and the West, and the triangle station will then become a junction for two large through lines, sanction having already been given to the section between the triangle and the Potsdamer Strasse. The accounts show the following results for the two years:—

	1912.	1911.
Share capital	£2,500,000	£2,500,000
Working receipts	415,000	414,000
Working expenses	206,000	199,000
Working surplus	209,000	215,000
Various receipts	79,000	60,000
Brought forward	31,000	21,000
Gross profits	319,000	303,000
Interest on loans	81,000	80,000
Renewal fund	36,000	36,000
Local taxes	8,900	9,000
Depreciation	3,600	3,600
Net profits and balance forward	176,000	162,000
Dividend	127,000	122,000
Dividend, per cent.	6	5¾

The dividend is on paid-up capital of £2,125,000, and the interest is on loans totalling £3,492,500. During the year the number of passengers carried was 62,731,827, as compared with 62,585,512 in the preceding year, and the average receipts per passenger were 1·52d., or a fraction less than in 1911. The train-miles run amounted to 2,347,275, the trains being composed of from two to four coaches, and the rolling stock at the end of 1912 comprised 143 motor coaches and 116 trailers. It is now proposed to increase the share capital by £500,000, and the loan capitalal also by £500,000, in order to provide for the extensions in progress or in contemplation.

Prospectus.—*Minas Geraes Electric Light and Tramways Co.*—The list was to close on Wednesday in an offer of £120,000 5 per cent. first mortgage bonds at 90½ per cent., the principal and interest being unconditionally guaranteed by the Government of the State of Minas Geraes, Brazil. A letter from the chairman of the company issued with the prospectus states as follows:—"The properties comprised in the lease include four electric generating plants, of which three are water-powers and one is steam. The first hydro-electric plant, situated on the River das Pedras, about 25 miles from the City of Bello Horizonte, has a capacity of about 1,600 H.P., and is now being equipped with a new unit of about 800 H.P. The company is now building a new transmission line with 300 steel towers. The second hydro-electric plant, situated on the River Santa Barbara, about 45 miles from the city, has a capacity of about 665 H.P., and is now ready for the installation of a new water turbine of about 330 H.P. A further 10,000 H.P. can be developed at this point when required. The third hydro-electric plant, situated on the River Arrudas, about three miles from the city, has a capacity of about 330 H.P., and is already fully equipped for the generation of electric power. The fourth is a steam plant, situated near the distributing station in the city, and is used as an auxiliary plant, its capacity being about 1,400 H.P. The company has the exclusive right, subject to the terms of the lease, for the period mentioned, to supply electric light and power and to operate the tramways and telephone system of the City of Bello Horizonte. The total length of the tramway system is 19 miles. The municipality has entered into a contract with the company for the public lighting of the city until 1965. In respect of the period from April 1st, 1912, to January 31st, 1913, the net earnings of the company, after allowing for the rental to be paid to the State, amounted to £12,327, being at the rate of £14,784 per annum, or sufficient to pay the interest and sinking fund of those bonds more than twice over. The company is paying dividends on its share capital at the rate of 7 per cent. per annum."

African Mica Mines, Ltd.—A prospectus is in circulation offering an issue of 60,000 shares of 5s. each in this company, which has been formed to acquire mining rights and work mica deposit in Transvaal Colony. Estimates given in the prospectus show on a sale of 50 tons of trimmed electrical mica, realising £500 per ton, a profit on the first year's working of £20,500. The nominal capital is £40,000 in 5s. shares.

South Metropolitan Electric Light and Power Co., Ltd.—The warrants for interest on the 4½ per cent. first mortgage debenture stock, payable on the 1st inst., for the six months ended that date, have been posted.

Rees Roturbo Manufacturing Co., Ltd.—According to a financial daily, after providing for administration expenses and interest on loans, the accounts for 1912 show a net profit of £2,031, thus converting the debit balance of £1,544 brought forward into a credit of £487, which the directors propose to carry forward.

British Aluminium Co., Ltd.

Mr. A. W. Tait (chairman) presided on Friday at Winchester House, E.C., over the meeting of this company.

The Chairman, in moving the adopting of the report (see Electrical Review, p. 533), said that the trading profit for the year, together with interest and dividend on investments and the revenue derived from the Kinlochleven and Foyers Estates and transfer fees, was £194,824, as compared with £152,902 for the previous year, or an increase of £41,922. The results for the year were satisfactory considering the prices which had ruled during the period, which were exceptionally low owing to the keen competition of foreign producers. The average price obtained for the metal was even lower than during the previous year, when prices were also at an unsatisfactory level. These results had only been achieved by a substantial increase in output and some decrease in cost of production. The increase in profits was almost entirely accounted for by the increase in the trading profit, which had risen from £140,378 in 1911, to £181,529 for the year 1912. There were slight variations in the amount of dividends on investments and interest on deposits, but the increase in the former was almost negatived by the decrease in the latter. There was also a slight decrease in the revenue from the Kinlochleven and Foyers Estates, and a small increase in the amount of transfer fees. The output and sales for the year were greater than in any previous year since the company's business was founded. The continued expansion in the demand for metal was an encouraging feature of the business, and if this continued the surplus of the productive capacity of all existing works over the world's consumption would be rapidly taken up. The contracts which had so far been made for delivery over the current year were satisfactory, and the prices, of course, showed a material improvement over those of last year, so that there was every reason to believe that when they came to present accounts to the shareholders next year, the position should show some further material improvement. The company had purchased the reduction and carbon works at Vigelands, near Christiansand Norway, which were controlled by the Anglo-Norwegian Aluminium Co. This purchase was concluded by the board after the works had been visited by their experts, and their reports duly considered, and in the opinion of the board, it was an advantageous purchase for the company. These works were well and substantially built, and were able to give a considerable production of aluminium all the year round. They were also capable of important development without very large capital expenditure. Part of the purchase price had been paid, and the balance of the purchase price would be paid within the next few months, and as this was being done entirely out of the internal resources of the company without the necessity of raising any additional capital, the shareholders would appreciate the considerable improvement in their position, owing to the fact that the company now controlled a substantially larger output than previously. These works were in full operation, and the company would obtain the benefit of it in the current year's accounts. The increase in the production of aluminium necessitated the increase in the company's capacity of production of alumina. In order to supplement the supply of the works at Larne, which were sufficient for the requirements of the three works at Kinlochleven, Foyers, and Stangfiord, the purchase had been made of one-half interest in the works of the Bauxite Refining Co., at Hebburn-on-Tyne, which gave the company the right to one-half the output of these works. Certain additions were at present being made to increase the capacity of these works, and it was expected that these extensions would be completed in the course of the next three months. At the last two meetings he had mentioned that extension had been carried out at the rolling mills at Milton, Staffordshire, which had now been brought up to their full capacity under existing conditions. In order to cope with the increased demand for the company's manufactures, arrangements had been completed for the acquisition of land and buildings at Warrington, Lancashire, and the site provided for considerable future expansion if necessary. These had been obtained on favourable terms, and contracts had been made for the supply of rolling plant, and it was expected that these works would be in operation at the end of this year, or the beginning of next. As the demand increased, further plant would be put in, so that the shareholders would observe that this was a growing and important part of the company's business. The directors were of opinion that it was a wise policy to extend this part of the business, because it enabled the company to be more independent of fluctuations which might take place in the demand for ingot metal, while the business was in itself a profitable one, which contributed a substantial amount to the general trading profits of the company. The demand for sheets and circles, tubes, and other forms, continued to grow in a satisfactory manner, and the increase in the demand from the electrical industry for the use of the metal in transmission lines, insulated cables, and switchboard work, showed encouraging expansion. All the works of the company had been operated satisfactorily during the year, and the whole of the plants had been maintained in a thoroughly efficient manner out of revenue. The plant installations referred to in the last report had all been completed, and were working satisfactorily. The reduction works at Kinlochleven, Foyers and Stangfiord, had been practically fully employed, and he was pleased to say that the reservoir capacity at Kinlochleven had been sufficient for all their requirements during the year, and at the end of the year the reservoir was overflowing. Trade in general for the year 1912 was considerably interrupted, and the company's business in particular was directly affected by the coal and dock strikes. The shareholders were probably aware that they were very large consumers of coal at their Alumina Works and at their rolling mills, but they were able, by making proper provision beforehand, to keep these works in full operation during the whole period of the coal strike. This, however, was only done at considerable cost, owing to the increased price of coal, and he was afraid that, as the result of that strike, coal prices were likely to be on a higher level for some time to come. There had also been a considerable rise in freight rates during the year, due to general commercial activity. They were, however, always endeavouring to improve their methods of production, and economies were being made from time to time, all of which had a cumulative and growing effect; and although last year suffered because of these abnormal expenses, he did not think that their costs of production should show any increase in the near future. In order to improve the labour conditions at Kinlochleven, some further expenditure had been incurred during the year, and the board had authorised the erection of further workmen's cottages for the accommodation of their workmen and their families. This expenditure was having a good effect in the gradual improvement in the standard of labour. In last year's report, it was mentioned that the company had authorised its subsidiary company, the Union des Bauxites, to complete the purchase of certain bauxite mines. This was done, and in order to ensure a large reserve supply, a considerable tonnage had been purchased by this company from the Union des Bauxites, which would be set aside for future requirements. This purchase would also enable the Union des Bauxites to increase considerably the development of its mines, so that a further large stock of the raw material might be built up. It was absolutely essential for this company that the reserves of raw material should be in hand for a long time ahead, and the arrangements which had now been made would ensure this. With regard to the Orsières power scheme, there was nothing new to report. The necessary development work mentioned at the meeting last year had now been carried out, so that the works could be maintained at the minimum cost. The company's rights were being properly protected, but it was not intended meantime to proceed further with the development of the scheme. The railway was being operated and maintained in an efficient manner, and the gross earnings were more than sufficient to meet the operating expenses. The chairman proceeded to deal with the salient features in the accounts and pointed out that the investments had increased from £571,255 to £749,217, due to the purchase of the Vigelands works and the interest in the Bauxite Refining Co. With regard to the liabilities, from now onwards the prior lien debentures would be gradually reduced by the application of the cumulative sinking fund of 1 per cent. per annum, whilst already £28,685 of debenture stock had been redeemed. After providing £17,420 for legal expenses, depreciation, &c., and proportion of profits payable to directors; £40,000 for prior lien debenture interest; £43,223 for debenture stock service fund; £40,000 for depreciation; and £30,000 to reserve account, the board recommended the payment of the 6 per cent. preference dividend, which left £10,206 to be carried forward. In conclusion, he congratulated the shareholders on the successful manner in which the company was emerging from its difficulties.

Mr. S. H. Pollen seconded the motion.

Mr. Kennedy asked what remuneration the directors received, and

The Chairman said they were entitled, under the articles of association, to 5 per cent. of the profits after payment of the prior lien interest of £40,000.

Mr. Kennedy: How much is that?

The Chairman: That is a matter of calculation; I am sure you can do it for yourself.

The motion was then carried.

Bromley (Kent) Electric Light and Power Co., Ltd.—The directors report that during 1912 the lamp connections increased from 101,276 to 107,649. The sale of current increased from £16,418 to £16,651. The works have been maintained in good order and repair. The result of the year's trading, including £703 brought forward from last year, shows a profit of £13,262, and after payment of debenture interest and trustees' fees, &c., amounting to £3,059, and writing off the balance of the cost of motor-car, and the cost of fitting up a new showroom, there is a balance of £10,044. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 8 per cent. per annum, making a total dividend of 6 per cent. for the year, and that £4,000 be placed to general reserve account, leaving £1,544 to be carried forward. To fill the vacancy caused by the death of Mr. R. Taylor, the directors propose the election of Mr. E. G. Peill, of Bromley. The meeting is to be held at Bromley on April 7th.

Vickers, Ltd.—Mr. Albert Vickers presided, on March 28th, at the annual meeting, and said that there was no reason to think that 1913 would be less favourable than 1912. Their subsidiary companies had brought much profitable business, especially foreign business. The report was adopted, and a dividend of 10 per cent. on the ordinary shares was approved. A resolution was passed to issue 740,000 new ordinary shares of £1 each at 30s., one new share to be allotted to holders for every five now held.

Dublin and Lucan Electric Railway Co.—Mr. J. W. Hill presided at the half-yearly meeting on March 28th, and moved the adoption of the report, which showed gross receipts £93 less than in the corresponding half of last year. The expenditure increased by £178. After paying 5 per cent. preference dividend, £378 is carried forward. The mechanical stokers had enabled them to save on the coal bill, notwithstanding the higher price. The report was adopted.

Automatic Telephone Manufacturing Co., Ltd.

The directors' report for 1912 states that the profit for the year amounts to £13,499. After payment of dividend on 6 per cent. preference shares to December 31st, 1912, £11,816, and deducting amount written off preliminary expenses, &c., £1,313, there remains a balance of £370 to be carried forward. The directors report that the transfer of the Liverpool works and business of British Insulated and Helsby Cables, Ltd., and the assignment of the patents of the Automatic Electric Co. were satisfactorily carried through, and the company commenced business on January 1st, 1912. In the early part of the year two automatic exchanges, each of about 500 lines, were completed for the British Post Office, and these exchanges have worked remarkably well throughout and continue to give good and efficient service. Other automatic equipment orders to the extent of about 8,800 lines have since been received, and the company is at present negotiating and tendering for a number of other automatic exchanges in this country and abroad. The works of the company at Liverpool have been considerable extended during the year, and good progress has been made in the manufacture of automatic equipment there. The manufacturing business taken over from British Insulated and Helsby Cables, Ltd., shows a satisfactory increase. During the year several manual exchange equipments were supplied or completed, and orders for manual exchanges to the extent of about 12,000 lines are now in hand. The telegraph business of the company also shows a material increase. This being the first year of the company's trading, nothing has been written off for depreciation.

The annual meeting will be held at Liverpool on April 7th.

STOCKS AND SHARES.

Tuesday Evening.

The greatest apologist for Stock Exchange markets must be fain to admit that the position of affairs generally speaking—politically, domestically and financially—is not all that it might be, and that the shyness which business shows in coming forward has, at all events, a good deal to excuse it. War news from day to day swings see-saw fashion, and although by the end of this week the termination of the struggle may be within actual sight, in these earlier days there is obviously plenty to do before peace can be confidently counted upon. With peace will, or should, come cheaper money, and it is to this last that the Stock Exchange is looking for relaxation of tension and anxiety.

The Home Railway market has had a bout of strength. Speculation ran strongly upon some of the lower-priced stocks, and Metropolitan Consolidated formed a conspicuous feature. The price was run up to 54, reverting later to 53¼, at which a rise of 2½ is left on the week. Districts rose 1¾, and the Underground Electric group improved at the same time. The rise in "Mets." was accompanied by a general tip to buy the stock; and since it is one of those which moves quickest in the Home Railway market, some of the bullish operators were content to take a hand. Talk has it that the price is to be put still higher, but it is not an investment for the nervous individual.

Another strong feature this week was London and South-Western Railway Deferred stock, where the price shot up suddenly, and this had the indirect effect of dragging down London United Tramways 4 per cent. Debenture stock, causing it to lose four points. It is argued that if the South-Western Railway is at last going to wake up and galvanise its suburban traffic on electric lines under the energetic new management, this may be bad for the London United Tramways Company. The East London electrification was started in working order on Monday last, and the price of the Ordinary stock hardened to 10½, to revert later to 10¼. Central London Ordinary rose 1, in connection with the jump in South-Westerns.

British Electric Traction issues are still somewhat dull, the 7 per cent. Preferred stock being ½ lower. City and South London 4 per cent. Debenture at 96 shed a point; and, considering the nature of the security, the yield of £4 2s. 6d., which this stock now affords, must be regarded as good.

The market for English Electricity Supply shares remains well-nigh comatose. County of London Ordinary shares went back to 11, but most of the other alterations are caused by the *ex*-dividend markings of last Friday. Brompton Ordinary recovered its dividend deduction, and Westminsters gained ½; otherwise the net movements are almost *nil*. Business, what there is of it, comes in fitful flickers. Even in City of London Ordinary there is hardly anything doing.

At the end of last week started a boomlet in most of the Mexican issues, prices of the railway and utility companies being run up substantially. A good part of the improvement is retained. Mexican Light and Power Common is up 3, and the Preferred 2½. Mexico Trams show a gain of 3½, while the Company's bonds of both classes are materially higher. Monterey Fives are a point to the good, and similar improvements were secured by other stocks in this group. At the same time, most of the Latin Canadians assumed better complexion. Brazil Tractions spurted 4½, to the accompaniment of vague rumours about a further and a larger rise yet to come. Montreals are 3 up, Shawinigans gained 7, and improvements were secured by Alabamas, Georgias, Columbia Electric, and similar shares. Mississippis rallied on the understanding that the disastrous floods have come nowhere near the company's area. Columbia Gas and Electric shares dropped to 12½ when it was announced that the town of Dayton was in the middle of the afflicted country, but this, it seems, is not the Dayton which is served by the Columbia Gas and Electric undertaking, the shares in which promptly rallied to 15½. Canadian General Electrics partially recovered the deducted dividends, and Rio Tramway bonds have hardened.

In connection with the Latin-Canadian group, mention must be made of a most serviceable volume which has just been published for its third year, dealing with the utility concerns of the Americas. The book, "Atkin's Manual," contains illuminating details of all the principal concerns, but what renders it of particular value is the fact that in many cases maps are provided by which the scope of the undertakings can be grasped with a readiness that would be impossible without this aid. The book is prepared by a firm in the Stock Exchange; and while one hesitates to use so hackneyed a word, the term "indispensable" is in this case no exaggerated compliment to pay it.

In the Telegraph market, Anglo-American Telegraphs are better. Eastern Ordinary is ½ up, Great Northerns have advanced, while West India and Panama, after showing the big jump of 6s. 3d. per share, lost part of the rise. The latter are being bought again by the same speculative division which on previous occasions has taken the market in hand, and the price is largely at the mercy of extrinsic considerations—such as political news, and so on. Telegraphs are not by any means active, but the tone of the market is good, and dealers declare that there is not much stock about. An increase of 4s. in the dividend on the Great Northerns caused the price to rise 50s. to 32½.

New York Telephone Bonds continue to creep up, being now quoted at 99¼. National Telephone Deferred is neglected, but keeps about 20½. Marconis rose to 4 7/16, from which they have reacted a little; but the Preference at 3¾ have recovered their loss of last week. The Automatic Telephone Company, the British Insulated "baby," announces a net profit for its first year's working of £13,500; and while no dividend is to be paid on the ordinary shares for the period, the future prospect is distinctly satisfactory.

There is little of interest to record in connection with the Manufacturing market. A recovery of 2 points, after its drop of 5 points, has resulted in Brush Second Debenture being raised to 27. Dick, Kerrs are quoted at 10s. middle, showing a loss of 2s. 6d. British Aluminiums retain their rise, and the 5 per cent. Prior Lien is up a point, in consequence, of course, of the excellent report, to which attention was drawn here. British Westinghouse 6 per cent. prior lien is better. Castner-Kellners at 3¾ have rallied, and in the armament market Armstrongs are the principal feature of strength, with a big rise on the proposal of the board to distribute as a bonus one new share for every four old now held. The rubber share market has been acutely weak, for which the incessant sagging of the price of the raw material is responsible. If the American buyers of the product do not come forward as they are expected to do, it seems likely enough that the price of rubber will go still lower, in which case, of course, it is only to be supposed that quotations for the shares will follow suit.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.	
		£	£*		£	£*		Inc.
Bath	Mar. 26	3,160	+ 575	13	9,400	+ 606	..	..
Blackpool-Fleetw'd	,, 29	2,115	+ 521	12	4,417	+ 917	8	..
Bristol	,, 28	29,727	+ 5,559	13	86,431	+ 10,076	30·5	..
‡Brit. Elec. Trac. Co.	,, 21	41,071	+ 4,839	12	256,245	+ 15,387	..	..
Chatham and Dist.	,, 27	3,416	+ 323	12	10,183	+ 657	14·98	..
Cork	,, 27	1,844	+ 34	13	5,402	— 57	9·89	..
Dublin	,, 28	22,014	+ 207	13	67,771	+ 1,130	54·25	..
Hastings	,, 27	3,649	+ 760	..	..	+ 858	19·3	..
Lancashire United	,, 26	5,976	+ 1,446	12	16,761	+ 2,082	39	..
Llandudno-Col. Bay	,, 28	966	+ 371	17	5,280	+ 809	6·5	..
London United	,, 29	13,417	+ 1,000	13	71,219	+ 831	..	..
Tyneside	,, 26	2,866	+ 586	13	5,912	+ 653	11	..
Anglo-Argentine	,, 25	255,420	+ 11,410	12	668,155	+ 46,720	..	..
Auckland	,, 14	19,576	+ 2,108	36⅔	179,096	+ 24,528	24·1	·8
Bombay (B.E.T.)	Feb. 27	12,960	+ 437	9	26,511	+ 629	..	..
Brisbane	,, 28	24,860	+ 16,160	8	47,670	+ 28,236	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Mar. 29	17,087	+ 1,044	..	..	+ 1,493	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..	..
Kalgoorlie, W.A.	Feb. 28	2,644	..	8⅓	5,378	..	20·5	..
Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 31	3,855	+ 379	13	10,560	+ 924	14·7	2
Montevideo	Mar.	33,140	+ 1,616	21	169,675	+ 12,347	..	..
Cen. London Rly.	Mar. 29	19,783	+ 952	13	62,348	+ 4,612	6·78	·4
City & S. Lon. Rly.	,, 29	11,609	— 1,100	13	39,219	— 4,186	7·26	..
Dublin-Lucan Rly.	,, 28	551	+ 65	13	1,491	+ 80	7	..
G.N. and City Rly.	,, 29	5,657	— 1,204	13	19,660	— 2,926	3·5	..
L'pool Overh'd Rly.	,, 30	6,175	+ 355	13	20,498	+ 1,356	6·6	..
London Elec. Ry. Co.	,, 29	56,325	— 1,920	13	189,425	— 1,880	21·25	..
Mersey Railway	,, 26	8,850	+ 648	13	29,289	+ 1,734	4·5	..
Metropolitan Rly.	,, 30	63,147	+ 3,413	13	212,124	+ 1,468	25·75	..
Met. District Rly.	,, 29	52,121	+ 1,929	13	171,333	+ 6,422	25	..

* Compared with the corresponding period of 1912.
‡ Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	6	1⅛ — 1⅛ xd	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8⅜ — ⅛	..	4 14 9
Do. Second 6 % Pref.	10	6	6	9⅞ — 10⅜	+ ⅛	5 15 8
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅛ xd	+ ⅛	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅜ — 8⅝ xd	..	3 18 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City Do. 4½ % Cum. Pref.	5	5	5†	4⅜ — 4⅞	..	5 2 7
	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	91½ — 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4¼ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	16 — 17½	..	5 6 8
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 —102	..	4 8 8
County of London, Ord.	10	6	6	10¾ — 11¼	— ¼	5 6 8
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	93 —102	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	5/16 — 3/4 xd	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4¼ — 4⅝	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	..	5 7 2
Folkestone	5	6	6	4½ — 5 xd	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4½ — 5 xd	..	5 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅞	..	4 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	+1	4 5 1
Metropolitan	5	4	4†	3⅜ — 3⅝ xd	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ — 4⅝ xd	..	5 5 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ —102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord.	5	2	2	⅜ — 1⅜	..	..
South London, Ord.	4	5	6	2¼ — 2⅜ xd	..	7 7 8
Do. 5 % First Mort. Deb.	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1 1/32 — 1 3/32	— 1/32	5 17 11
Do. 4½ % First Deb. Stock	100	4½	4½	94 — 97 xd	..	4 11 3
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅛ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86 xd	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 9	+ ⅛	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 3
Calcutta, Ord.	5	8½	7†	6⅜ — 7⅛	+ ⅛	5 19 4
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	93 — 95	+1	5 5 8
Canadian Gen. El. Com.	$100	7	7	113 —117 xd	..	5 19 8
Do. 7 % Pref.	$100	7	7	119 —123 xd	..	5 12 10
Cordoba Lt., Power and T., Ord.	1	3		1/4 — 5/16	..	5 14 3
Do. 5 % Deb.	100	5	5	13½ — 96½ xd	..	5 3 8
Elec. Lt. and P. of Cechabamba, 7 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	3/4 — 7/8	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	..	4 16 7
Madras, Ord.	5	Nil	..	1⅜ — 1½	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	81 — 84	..	5 19 0
Mexican Lt. & Power, Common	$100	4	4†	79 — 82	+3	4 17 7
Do. 7 % Cum. Pref.	$100	7	7	103 —106	+2½	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	92 — 94	+1	5 6 5
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83 — 86	+1	5 16 3
Montreal, Lt., H. and Power	$100	8	9†	225 —230	+3	3 18 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	105 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	140 —145	+7	3 9 0
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	..	4 7 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	97½ — 99½	..	4 10 6
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	11 7/32d.	17 3/32d.	13/32 — 15/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7⅛	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	133 —135 xd	..	5 16 10
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph	Stock	8	8	6⅛ — 6⅝	+ ⅛	4 8 3
Do. 6 % Pref.	Do.	6	6	111⅛ —112½	+ ⅛	5 6 8
Do. Def.	Do.	80/-	..	24⅜ — 24⅝	..	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99½ —101½	..	4 18 6
Chili Telephone	5	7	8	7 1/16 — 7 2/16	..	5 1 1
Commercial Cable, Stg. 4% Deb.	Stock	4	4	80 — 82 xd	+2	4 17 7
Cuba Telegraph	10	6	6†	8 — 9	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3 3/32 xd	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¾ — 7 xd	+ ⅛	7 2 10
Direct United States Cable	10	5	4	6⅜ — 7⅛	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	134⅛ —137⅜	+ ⅜	5 1 8
Do. 3½ % Pref. Stock	Do.	3½	3½	78½ — 80½	..	4 6 11
Do. 4 % Mort. Deb.	Do.	4	4	9⅜ — 97	..	4 2 6
Eastern Extension	10	7	7†	12⅜ — 13⅜	..	5 4 8
Do. 4 % Deb.	Stock	4	4	96 — 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	1 1/16 — 1 1/8	..	5 7 10
Do. 6 % Pref.	10	6	6	12½ — 13	+2⅛	4 12 4
Great Northern Telegraph	10	18	20	31½ — 33½	..	5 19 5
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	100	5	5	80 — 82	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 69	..	5 16 0
Marconi's Wireless Telegraph	1	20	..	4 5/16 — 4 7/16	+ 1/16	4 10 1
Do. 7 % Cum. Partic. Pref.	1	17	..	1 5/8 — 1 7/8	+ ⅛	4 7 10
Monte Video Telephone, Ord.	1	6	6†	1 3/16 — 1 5/16	..	5 13 0
Do. 5 % Pref.	1	5	5	1 1/8 — 1 3/16	..	5 14 3
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98¼ — 99¾	+ ⅛	4 10 3
Oriental Teleg. and Elec.	1	6	6†	13/16 — 14/16	..	4 7 0
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11¼ — 11¾	..	8 10 2
Do. New Shares	10	..	..	10 13/16 — 11 1/16	..	..
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 13 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	..	4 11 10
United River Plate Telephone	5	8	..	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅝ — 1 1/8	..	4 9 0
West Coast of America	2½	2½	..	1¼ — 1⅜	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 1/16 — 3 3/16	+ 1/16	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13 — 13	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ — 100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 1st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	74 — 79 xd	..	5 14 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	9 — 11	..	..
Do. Do. Deferred	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85½ — 88½	..	6 15 7
Do. 7 % Non-Cum. Pr'f.	100	..	..	84½ — 87½	— ½	..
Do. 5 % Perp. Deb.	100	5	5	88½ — 92½ xd	..	5 8 1
Do. 4½ % 2nd Deb.	100	4½	4½	75 — 79	—2	5 13 11
Central London Railway, Ord.	100	8	8	79 — 81	+1	‡4 18 9
Do. Pref.	100	4	4	83 — 85	..	‡4 14 2
Do. Def.	100	2	2	78 — 80	..	‡5 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & S. London, 5 % Pref., 1891	100	5	5	99 —102	..	4 18 0
Do. Do. 1896	100	5	5	99 —102	..	4 18 0
Do. Do. 1901	100	5	5	97 —100	..	5 0 0
Do. Do. 1908	100	5	5	95 — 98	..	5 2 0
Do. 4 % Deb.	100	4	4	95 — 97	−1	4 2 6
Dublin United Trams, 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 18 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅜ — 2⅝	..	Nil
Hastings Trams, 6 % Pref.	1	6	6†	7/8 — 1 3/8	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	66⅔ — 71½ xd	..	6 6 4
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4¼ — 5	..	..
Do. 4 % Deb.	100	4	4	61 — 65	−4	6 3 1
Metropolitan Railway Consol.	* 100	1911. 1⅞	1912. 1⅞	52 — 53½	+2½	£ s. d. 3 1 0
Do. Surplus Lands	100	2⅜	2⅜†	61 — 63	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	..	4 4 4
Metropolitan District Ord.	100	Nil	Nil	39⅜ — 40¼	+1⅛	Nil
Do. 6 % Deb.	100	6	6	135 —137	..	4 7 7
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	98 —100	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	29/32 — 1 1/32	..	5 18 6
Do. 5 % Pref.	1	5	5	1/4 — 13/32	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½ xd	..	5 5 10
Potteries, Ord.	1	3½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	13/32 — 15/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	13/16 — 15/16	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4¼ — 4½	+ ⅛	Nil
Do. "A"	1/-	..	..	1/16 — 1/16	+1/32	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	..	5 9 1
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 6 % Income	100	1½	6 †	92½ — 93½	+1	6 8 4
Yorkshire (West Riding), Ord.	5	Nil	..	1/32 — 3/32	..	Nil
Do. 6 % Pref.	5	3	3†	2⅞ — 3⅛	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	6½	4⅛ — 5 1/16	..	5 8 7
Do. 2nd Pref.	5	5½	6½	4 3/16 — 4 5/16	..	5 14 8
Do. 4 % Deb.	100	4	4	8½ — 9½	−1	4 7 5
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅜	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	100 —102	+4½	..
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ — 7⅝	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	131 —136	..	5 17 8
Do. Pref. Ord.	100	6	6	112 —117	..	5 2 7
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 4
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	94½ — 96½	— ½	4 8 1
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97½ —100½	..	4 9 7
Cape Electric Trams	1	2½	..	1/16 — 1/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 9/16	..	4 8 0
Do. 4 % Deb.	100	5	5	95 — 99	−1½	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 8 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	15/32 — 17/32	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1½	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb.	100	5	5	102 —104	..	4 16 2
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	111 —113	+3½	6 4 0
Do. Gen. Con. 5 % Bonds	..	5	5	93 — 95	+3	5 5 3
Do. 6 % Bonds	100	6	6	97½ —100½	+2½	5 19 6
Para Elec. Rlys. & Lt., Ord.	5	10	10	7 — 7½	..	6 13 4
Do. 6 % Pref.	5	6	6	4⅞ — 5⅜	+ ⅛	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —102	+ ½	4 18 0
Do. 5 % Mort. Bonds	100	5	5	94½ — 95½	+1	5 4 9
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101 —103	— ½	4 17 1
Singapore Trams, 5 % Deb.	100	5	5	83½ — 87½ xd	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video	5	7	6†	5 — 5½	—	6 7 3
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —101	..	4 19 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½ —101½	..	4 8 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	1/8 — 3/16	..	8 0 0
Do. 6 % Pref.	1	6	6	3/32 — 5/32	..	7 2 2
Babcock & Wilcox	1	28	14†	8 1/16 — 8 3/16	— 1/16	4 6 5
Do. Pref.	1	6	6	1⅛ — 1⅜	..	4 0 0
British Aluminium, Ord.	1	Nil	..	3/32 — 5/32	..	..
Do. 6 % Cum. Pref.	1	Nil	..	1/16 — 3/16	..	..
Do. 5 % Prior Lien Debs.	100	5	5	92 — 95	+1	5 6 5
Do. Deb. Stk.	100	5	5	87 — 90	..	5 11 1
B.I. & Helsby Cables	5	10	10	7⅜ — 8⅛ xd	..	5 15 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref.	3	Nil	Nil	1/16 — 3/16	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	101 —104	+1	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	4/6 —5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ¼	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb	100	4½	4½	88 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	25 — 29	+2	16 13 4
Callender's Cable	5	15	10†	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Casmer-Kellner	1	20	20	3 1/32 — 3 3/32	+ 1/32	5 5 3
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	..	1/8 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	3/32 — 5/32	— 1/32	..
Do. Pref.	1	6	6	3/16 — 5/32 xd	..	7 13 10
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	1/32 — 3/32	..	Nil
Do. fully paid	5	Nil	..	1/4 — 1/2	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Do. 5 % Second Deb.	100	5	5	70 — 73 xd	..	6 17 0
Electric Construction	2	2½	3⅛	1 1/32 — 1 1/16	..	5 14 4
Do. Pref.	2	7	7	1 15/16 — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	10 — 10⅜	..	4 13 0
Do. Deb.	100	4	4	88 — 93 xd	..	4 6 0
Henley's, Ord.	5	15	15	12½ — 13	..	5 15 5
Do. Pref.	5	4½	4½	4½ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	17½	84 — 86	..	5 16 8
Do. Deb.	100	4	4	95½ — 98½	..	4 1 3
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

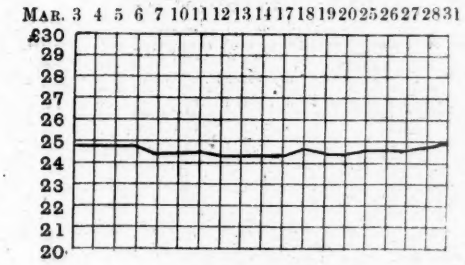
* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 5 per cent., October 17th, 1912.

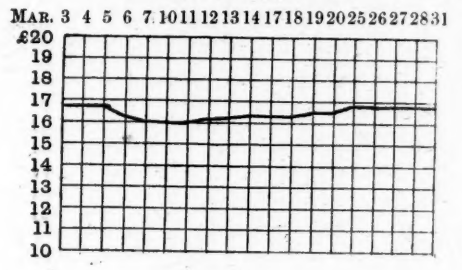
METAL MARKET.

Fluctuations in March.

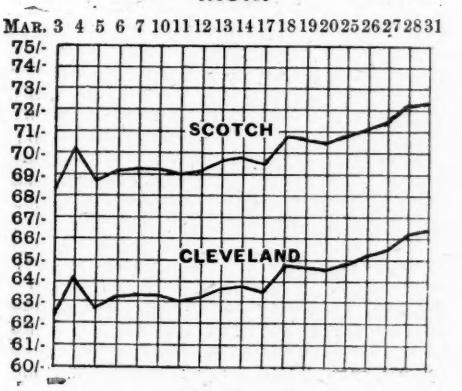
SPELTER (G.O.B's.).



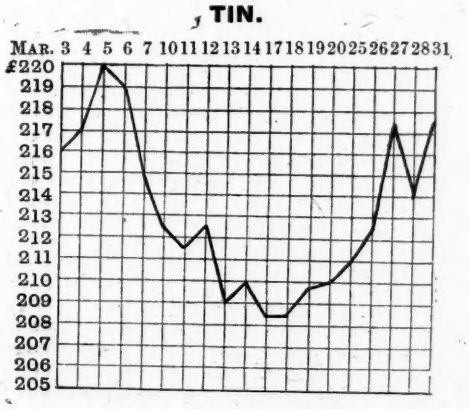
LEAD (ENGLISH).



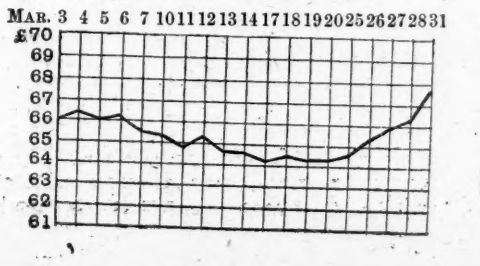
IRON.



TIN.



COPPER (G.M.B's.).



ELECTRIC COOKING APPARATUS.

By "ELEMENT."

Electric cooking may now be considered as well beyond the early experimental stage, but its development and general adoption must, of necessity, be extremely gradual, even after the ideal apparatus has been put on the market. It is not intended, in this paper, to dwell on the many advantages of this system of cooking, but rather to plunge at once into the matter of the construction and working of the apparatus. It is sufficient to state that the merits of the system are so great that the few shortcomings, which at present tend to hinder its general use, are almost negligible when compared with the many disadvantages of other methods of cooking. Granted that we have reasonable prices for energy, and that the more costly apparatus may be obtained on hire from the local supply authority at a nominal rental, then it may safely be said that the most convenient and economical method of cooking is within the reach of anyone who has the electric supply cables laid into his or her house. With electricity, there are no noxious fumes to cause a smell in the kitchen; no dust or dirt is caused by the use of electricity; and an improvement in the appearance of the food will be noted by those who generally have their food cooked by coal or gas. The shrinkage in the food cooked in an electric oven is found to approximate one-tenth, as compared with one-fourth when the article has been cooked in a gas oven.

These considerations are weighty in themselves, but they are not sufficient to warrant the householder in discarding, say, a gas cooker. They must be backed up by strong and reliable apparatus, or electric cooking will undoubtedly fall into disfavour. It must be remembered that the appliances will be in the hands of the good lady of the house, or the domestic servant, whose business is to cook, and not to look after complicated electrical machinery. The appliances must, therefore, be "fool-proof," so that mistakes will not have very dangerous consequences. Most of the serious defects in the early cooking outfits have now been remedied, and the only stumbling block to makers of this class of goods seems to be the manufacture of a heating element which will give a high efficiency with *absolute reliability*. Some of us are familiar with the cry: "The electric apparatus has broken down." A trivial oversight has resulted in a stoppage of the electricity flowing through a heating element, or a drop of water has, perhaps, been spilled on a portion of an exposed wire. But the breakdown is enough to make a topic of conversation for a few hours afterwards, and the result is a set-back in the development of electricity for domestic purposes. The same outcry might also be brought about by an appliance with defective insulation. Someone receives a slight electric shock from the surface of a kettle, and the electric method is thereupon condemned as "highly dangerous."

The apparatus, then, must also be electrically perfect, in having reliable heating elements, well insulated from the other parts, and in having all exposed metal efficiently connected to earth. Makers are now turning out cookers with a guarantee against breakdown within five years, and it would seem that we have now almost reached the stage when little trouble should be experienced under this head. It would be impossible, within a short article, to detail all the different types of electric cookers, but a brief description will be given of a few which have come under the notice of the writer. We are all familiar with electric kettles, electric stewpans and frypans, milk boilers, &c., with their self-contained elements. The latest forms of these are most efficient utensils, some of them attaining an efficiency of over 90 per cent. For fast cooking by electricity, they are, without doubt, the proper appliances. It is possible, by the use of an electric kettle, to boil 1 pint of water in less than four minutes, which is quick enough to satisfy the most impatient housewife, and this is obtained with an expense of $\frac{1}{15}$th of a unit, which, at $\frac{3}{4}$d. per unit, works out at $\frac{1}{20}$th of a penny, so that with this utensil the operation of boiling one pint of water 20 times entails a cost of only 1d., where energy is sold at $\frac{3}{4}$d. per unit for heating purposes.

The great drawback to the use of self-contained appliances,

however, is, of course, the confusion of flexible leads, where many cooking operations are in progress at one time, and this has led some makers to confine most of their experiments to the design of separate heating appliances on which ordinary utensils may be used. And in this pursuit, the principal difficulty has been to design an element which will immediately impart its heat to the vessel placed over it, without great loss of heat in the material supporting the element. This necessary loss of heat must appreciably lower the efficiency of the method. With the use of hot-plates the efficiency is between 60 and 70 per cent., showing that the best arrangement of apparatus, taking account of the before-mentioned objection to self-contained appliances, will be that in which roasting, grilling, frying, &c., are carried out on the separate heater system, and a self-contained, heavily-loaded kettle or urn is provided for the quick boiling of water. The utility and economy of a combination such as this would, it is believed, outweigh its possible disadvantages in one or two isolated cases.

In considering the many types of heating units, let us refresh our memory regarding the elementary principles underlying the transmission of heat from one body to another. As is well known, heat is transferred by radiation, convection, and conduction, and it will be seen that all three modes of transference have been tried by electrical manufacturers in their endeavours to further the cooking business. The sun's heat is *radiated* to the earth during the day; heat currents are *convected* through liquids and gases without luminosity; and *conduction* takes place when substances at different temperatures are in actual contact with one another. Let us see in what manner these fundamental principles have been applied in the various types of cookers to be considered.

The element in one firm's goods consists of lamp-heaters fixed in a cast-iron case forming an oven, grill and hot-plate. The heat is radiated from the lamps to the food or the vessel containing the food. This form of cooker never was successful, as the lamps were too easily destroyed by drops of water or grease breaking the glass bulbs. Another maker uses spiral resistance wires placed in a quartz tube. The objection to the lamp heater applies to the quartz system also, although the cost of renewal of the quartz tubes is not so great as that of the replacement of an entire lamp in the first-mentioned type. The purpose of the quartz tube is to increase the incandescence of the element so that more radiated heat is emitted, but it also serves to hinder the process of oxidisation of the wire when at a red heat. Notwithstanding this precaution the quartz type of element "burns out" very readily, and on this account no great reliance can be placed on it. A small hot-plate with a quartz element has lately been put on sale, consuming about 200-300 watts, but it cannot do the electric cooking business much good, as its construction and wattage only render it of value where the maintenance, and not the raising, of temperature is required. Instructions issued by the manufacturers of this small article contain a list of its accomplishments, which include "the heating of dinner plates, the maintenance of boiling temperature in a kettle, the roasting of chestnuts, and the boiling of an egg," but a footnote carefully informs the reader that one must first of all procure the hot water in which the egg is to be boiled. This hot-plate, no doubt, fulfils the purpose for which it is intended, but it seems that to expend energy at the rate of 300 watts "to roast chestnuts" is a wicked waste of electrical energy, and an uninitiated person might be pardoned for thinking from the appearance of the hot-plate that it should do the ordinary work of a gas-ring.

Several manufacturers have convectors, &c., made up with elements of metal deposited on mica sheets, and these have also been fitted to ovens, grills and kettles. The heater usually consists of a deposit laid between two short strips of mica in such a way that air is prevented from reaching the metal; consequently little oxidisation takes place at high temperatures. The elements are placed in parallel, so that should one burn out the others will not be affected. Another advantage is that, as there is not much material surrounding the element, the heat passes off as soon as it is generated. It is evident, too, that with an oven having heaters of this type renewals can be fitted expeditiously.

Then we have the composition known as "silundum," which may be heated to a very high temperature—about 3,000° F.—without oxidising. This material has been used in the construction of electrical cookers, and the results have been fairly satisfactory, but the efficiency does not seem to be very remarkable.

A few years ago electric ovens having cartridge elements were turned out by a well-known electrical firm. Each cartridge was formed of a spiral of resistance wire, wound on an asbestos cylinder, and inserted and sealed in a metal tube. Three elements were placed in the oven—two in the bottom and one at the top. Owing to the large amount of material forming the element, the efficiency was not good, and, therefore, little has been done in the improvement of the cartridge heater. Other forms have spiral wires, in some cases supported on, and in others embedded in, enamel or porcelain, and this brings us to the question whether the heating wires should be exposed to the atmosphere, or enclosed in mica or other insulating material, unaffected by reasonable temperatures. Exposing the element to the oxygen of the air limits the temperature to which the wire may be raised, while deterioration of mica occurs in the enclosed element when subjected to the higher temperatures; so that at the present time, elements must be designed which have a large dissipating surface per unit of power consumed, otherwise the apparatus will be liable to breakdown through overheating. In the cast-iron hotplate, lately brought out, one might suppose we had the ideal electric cooker, and it certainly is an improvement on former attempts, but considerable energy has to be expended in heating the cast-iron *slowly*, to prevent the deterioration already alluded to. If a substitute for mica were discovered which did not perish with great heat, cookers could be designed with a high initial wattage, giving a quick rise of temperature on the element, after which the power could be automatically reduced to a value sufficient to maintain the high temperature. This would, it is believed, be the cooker *par excellence* if the elements were constructed in a solid and reliable manner. Putting aside the objection of the slow initial rise of temperature in the existing hotplate system, the arrangement has much to be commended. The heating resistance is a flat spiral strip laid between two sheets of mica, which are inserted in an imperishable cast-iron disk. Expansion and contraction of the iron are allowed for, and the whole is fixed on the top of an iron support with the disk projecting above the level of the supporting frame. Ordinary utensils may be heated on the disk, but greater efficiency is, of course, obtained by the use of special vessels having flat ground bottoms to ensure good conduction between the disk and the utensil, and having bright, polished surfaces to prevent the escape, by radiation, of the heat. It is well known that a black surface will radiate heat quicker than a brightly polished surface, so that, to obtain the best results, it is necessary to have the sides of the utensils polished, while the surface of the hot-plate and the bottom of the vessel should be a dull black. It must be remembered, however, that the contact areas should be quite clean and free from soot and other non-conducting material. The hot-plate should also be fixed to its support in such a way as to prevent, as far as possible, the transmission of heat to the other metal parts of the cooker. This will ensure that almost all the heat generated is brought to the exact position where it is required for cooking purposes. The tinware vessels, supplied by the makers of the cooker, have special flat and very thin copper bottoms, which not only fit well on the top of the plate, but also overhang round the edge of the plate. It has been found in practice that the overhung rim of the utensil becomes too hot on account of the heat transmitted to this portion not passing off quickly, and thus the rims of utensils very soon get burned and cause leakages from the vessels. The best utensils are, therefore, those of cast metal having a dull bottom and highly polished on their other surfaces. An oven is provided to fit over the hot plate, and, to give additional heat, a second hot plate is inverted and placed in an opening in the top of the oven. The oven, as in the case of the other utensils, has polished surfaces, and a further precaution against loss of heat is given by the provision of an air space between the outer and inner walls of the oven. The whole apparatus can be used in a great variety of ways, and advantage may be taken of all the heat generated in the plates. A complete set consists of a

double cooker, having two hot-plates on one frame, an extension plate for the top of the oven, and an assortment of utensils for use with the apparatus. To the back of the frame is connected a flexible armoured cable which carries all the current required for the three hot-plates.

A Scotch firm of manufacturers has recently put forward an electric cooker, which, with the possibility of improvement, bids fair to become the ideal cooker we have looked for. The makers have copied, to a certain extent, the design of a gas cooker, in having a cast-iron oven for roasting and baking, two hot-plates on top for boiling, stewing, &c., a double grill and toaster, and a hot cupboard for keeping food warm, warming plates, or for slow cooking. The oven is lined with white porcelain enamelled steel sheets, and fitted with an inner glass door, so that food can be examined while cooking without loss of heat. It also has a thermometer graded to show what temperature of oven is required for the various cooking operations. The grill is fitted with white enamelled sides and back, and both oven and grill are thoroughly lagged with asbestos. The elements are of thick high-resistance spirals mounted on fire-brick, and so arranged in sections that it is a matter of minutes to replace a section should it burn out. It will be interesting to see how the claims for reliability of the new cooker are borne out in practice. From its similarity to the gas cooker it at least has the advantage that no special instructions in its use need be given to anyone familiar with the working of a gas cooker.

The control of electric cookers has always been a difficult problem for manufacturers. Good appliances have been completely spoiled for lack of perfect switching arrangements. In the case of the disk stoves, two switches are provided—one to give full heat and the other to give about one-third of full heat. To obtain even distribution over the plate at both degrees of heat, the element must be divided into two parts, and the switches arranged so that on top heat the two portions are in parallel, while on "low" the current passes through them in series. To allow of this, one maker has double-pole tumbler switches, which have been designed with no great heed to proper insulation between poles, and practice has shown that, after being in use for some time, the insulation breaks down, and arcing across the full pressure takes place on switching off. In another type, three two-way switches have had to be linked together to give the desired change from series to parallel in the two parts of the element. A firm of accessory manufacturers has, however, come forward with special, well-designed switches of ample capacity, and having the necessary insulation resistance, and little trouble should be experienced from this source in future where the new pattern of switch is adopted.

It is desirable to fix the control switches on a separate board close to the cooker, unless a position *on* the cooker can be selected where they will not be damaged by water or heat. Connecting wires should, however, be as short as possible, as a great many breakdowns to ovens and hot-plates occur in the leading-in wires. They should also be of much heavier wire than the heating element. One switch only, having several positions, should be fixed to control each complete heating element, and as the top heat is always required in commencing operations, the positions should be arranged so that the handle of the switch can be moved directly from "off" position to the point connecting with full heat, and from "full" to the lower values before switching off. This arrangement, it will be observed, also tends to minimise the arcing at the switch contacts on inductive circuits. A single-pole enclosed clip fuse (a "Zed" fuse is almost ideal) should be inserted in the circuit with each element.

It is of great importance that the cook should know, not only that the switch is "on," but also that current is actually flowing through the element, and where the latter is not exposed to view, some method must be devised to show that current is passing.

A small pilot lamp at a convenient point has been tried, and in some instances, switches have been used which are provided with small glow lamps behind the index, which indicate not only that current is flowing, but also the relative strength of the current. These special devices naturally increase the cost of an electric cooker to a figure which may seem ridiculous when compared with the cost of a gas cooker, but it is quite decided that apparatus for use with electricity must necessarily be very much more expensive than gas appliances, and it will be a great mistake if the development of electricity for cooking is hampered by leaving out devices which tend to greater reliability. Certainly the public will require to be educated in the new way of cooking, no matter how simple the apparatus may be, just as it had to be familiarised with gas cookers when these first came into vogue. With handy controlling gear on an electric cooker it will be evident that once a cooking operation has been carried out satisfactorily, the same satisfaction should be obtained again for the same operation, with the switches arranged and time allowed, as in the first case.

Cheap sets of breakfast outfits are to be had, consisting of a hot-plate, frypan, stewpan, and an electric kettle, and the results attained with these compare very well with those of the ordinary gas-ring, if we neglect the delay occasioned through the initial raising of the temperature of the hot-plate. It is easily possible to cook a breakfast by electricity for three persons within half an hour with an expenditure of less than half a unit, taking full advantage of the heat stored in the hot-plate after the current is switched "off." When account is taken of the enormous waste in the ordinary kitchen fire —about 90 per cent.—and the losses which occur with a gas-ring through radiation of heat from dirty utensils, and on account of soot on the bottom of kettles, &c., it will be seen that the electrical method is, after all, a very efficient system.

The loading of the elements of cookers has already been briefly referred to. The wattage for hot-plates should not exceed 23 watts per sq. in. of boiling-plate surface where mica enters into the construction, and should not be less than 20 watts per sq. in. A higher loading than 25 watts per sq. in. will disintegrate the mica and destroy its insulating properties.

In the foregoing notes an endeavour has been made to emphasise the fact that to popularise electric cooking, the apparatus must be *absolutely reliable* on all occasions. Elements will, naturally, burn out through time, but they must be so constructed that only that portion which gives way will be affected, and a complete stoppage of the cooking made an impossibility. The heaters must be cheap, and so simple that any housewife may be able to replace them in a few minutes. So far as present knowledge goes, we have not quite got the ideal apparatus, and it is to be earnestly hoped that, as the price per unit is still further reduced by supply authorities, manufacturers will on their part leave nothing undone in their attempts towards the perfecting of their electric cooking apparatus.

DUMPING: A NOTE ON A PARTICULAR CASE OF DISCRIMINATIVE CHARGES.

By JOSEPH GOODMAN, A.M.I.Mech.E., A.M.I.E.E.

In the following note it is not intended to treat the above question fully or in any way dogmatically, but it is written with the hope that any person who will bear with the arguments to the end, will be sufficiently interested to think for himself on the matter, and not content himself with the popular view, which usually only leads to a deeper misconception of the principles involved.

When considering the question of dumping, it is well to define at the outset the particular meaning attached to the word in the particular instance under notice, or, in other words, to distinguish between the various kinds of dumping.

The dumping of surpluses may first be considered. The manufacturer of a certain article can seldom, if ever, predict the exact demand that there will be in any certain period of time for that article, but he will, at any rate, see that he is not short of the amount that will bring him a maximum of profit; hence it frequently occurs that his supply is excessive, and a surplus arises.

Now, as a matter of business, the manufacturer will

probably prefer to keep a fairly high price level in his home market; this means that he will restrict his supply to the home market, and will dispose of the surplus, which consequently arises, in the foreign market.

This surplus will, as a matter of fact, sell at the price which then obtains in the foreign market for that particular article, which price, however, may actually be lower than the figure which would leave any profit for the manufacturer, were his whole output to be sold at that particular price.

It is at once seen from the above that in this case a surplus may be considered as a quantity of output which would not have been manufactured if the price for which it was to be sold had been foreseen.

A second kind of dumping is that which consists in deliberately manufacturing an excess so that increased quantities of the manufacture can be sold abroad (at a loss) in order to advertise the goods or to drive competitors from the market. It is, however, very doubtful if any manufacturer would adopt this plan in view of the excessive cost (except possibly in the case of some unique article, where it might be done to create a market, the price being afterwards raised when the public taste had been whetted).

With regard to competitors the above course would be feasible if actually the competitors could be driven from the field with small chance of recovery within a reasonable time. It will be seen that this should not be the case in ordinary commercial life.

Take the case of the old-established industries; these would work and sell for many years below their full cost of production (*i.e.*, including standing charges) rather than shut down, since shutting down would mean the destroyal of their plant. They would manufacture so long as the selling price was well above the works cost of production, *i.e.*, exclusive of standing charges, which would not be saved by a shut down.

Again, taking the case of other industries so controlled that, directly prices become in the least unremunerative, their output immediately contracts; it is equally fair to assume that immediately upon a recovery in price, which would again render manufacture profitable, the output can be as easily increased.

Briefly, it seems probable that competitors who are easily driven from the market when prices are unfavourable, are easily rallied on an improvement in the market; whilst those competitors who are not easily routed, can only be finally driven out of the market after a long and expensive campaign. Also in either case an eventual rise in price occurs which involves the danger of losing the custom which was obtained at the lower price; in short, the commodity must be somewhat unique or indispensable for such a course to be taken.

Finally, one may consider dumping in which there is to be no ultimate raising in price, *i.e.*, the commodity is sold at first, and for all time (in the foreign market), at a price which is below the cost of production. This is a very different case, and is a much more feasible and business-like proceeding. Such a supply has to be manufactured that after the home demand has been satisfied at a high or moderately high price, a quantity is still left which has to be sold in outside markets at a price below the cost of production.

An ordinary method of argument, attempting to show that the policy pays, is to say that the manufacturer can afford to sell at a loss in the foreign market, because he obtains more than a normal profit from his home sales. This necessitates explaining why, when he is making easy money at home, the manufacturer deliberately determines to carry on a losing trade with foreign customers.

It can, however, be shown that under favourable conditions, it is possible for a manufacturer to sell continuously abroad at a price below the cost of production, cost of production being understood to mean the average cost (cost per unit) over the whole of the output manufactured. Then sales in a foreign market at a price beneath the cost of production will be profitable, provided that the foreign price is greater than the additional cost made to the total costs of the industry by the production of the additional exported quantity of output, when this additional cost is estimated per unit of the exported output. Hence we see that the industry must be subject to increasing returns.

The fact that the foreign market (*i.e.*, increased output) is deliberately catered for in manufacturing, involves the expansion of the industry, and the enlarged industry properly organised means a lower cost of production per unit of the article or commodity manufactured. In addition to this must be reckoned the reduction in the cost of articles still sold on favourable terms in the home market.

N.B.—When the expansion of a business is accompanied by a fall in the marginal cost, it is usual to say that the business is subject to increasing returns; if the expansion is accompanied by a rise in the marginal cost, it is usual to say that the business is subject to decreasing returns.

The above involves the term "marginal cost":—Suppose a firm manufacture in any period one thousand boots, then the additional cost of production incurred by manufacturing the last boot over and above the previous nine hundred and ninety-nine boots may be taken as giving the "marginal cost"—a crude explanation of an important term, but sufficient for the present purpose.

PROCEEDINGS OF INSTITUTIONS.

Electric Heating and Cooking.

The Yorkshire Local Section of the Institution of Electrical Engineers discussed this subject on March 12th, 1913. In opening the discussion, Mr. Thomas Roles said the subject was one which, in his opinion, was of the greatest moment to the electrial industry. As far as he had been able to ascertain, the United Kingdom was well ahead of all other countries as regards both the manufacture and use of electric heating and cooking apparatus. This progress has been principally due to three causes, viz.:—(1) The reductions which had been made in the prices at which the apparatus was sold; (2) The reduction in the prices charged for electricity used for such purposes; and (3) the more active steps which had been taken to make public the advantages of the use of electricity and to push its sale.

The remarkable developments in the application of electricity for power purposes had overshadowed to a large extent the question of the use of electricity for heating and cooking purposes, as supply engineers and contractors had had their hands full in dealing with work in connection with power supply.

In areas where few manufacturing industries were in existence, the local electrical engineers had had to turn to business and domestic premises as the only outlets for increased output, and in a number of instances the heating and cooking problem had received the special attention at their hands which, in most manufacturing centres, had been given to the question of power supply. In one of these areas—viz., the Metropolitan Borough of St. Marylebone—an average of over 150 kw. of electric heating and cooking apparatus was being installed per month, and nearly 200 complete electric cooking outfits were on hire by consumers from the supply undertaking. This had been accomplished in the face of very keen competition on the part of the large company supplying gas in the borough. He could unhesitatingly state, from actual experience, that there was a demand for electric heating and cooking in manufacturing districts, and it was his belief that this demand would grow rapidly, with the result that in a few years' time electric heating and cooking would to a greater of lesser extent become an everyday practice in the majority of houses having electric lighting installations, and that eventually electricity would be far more popular than gas for these purposes.

The invariable experience of those engineers who had energetically tackled the heating and cooking problem was that they had not been troubled by excessive peak loads, but had benefited by a general increase in output and load factor.

Up to December 31st last, the total capacity of the heating and cooking apparatus which was known to have been connected to the Bradford Corporation mains, exceeded 1,000 kw. Included in this figure were the following appliances which had been connected by consumers who had adopted the special domestic rate:—251 radiators, 138 irons, 27 kettles, 25 cooking ovens, 12 hot plates, and other small utensils, such as shaving-pots, milk and egg-boilers, toasters, &c. A very considerable number of the connections, however, were only represented in the department's books as plugs, and when apparatus was purchased for attachment to these, in the majority of cases no formal notification was made. There were undoubtedly very considerable numbers of radiators, irons, &c., connected to the Bradford mains which were not included in the above figures.

The number of cooking outfits connected might have been very considerably increased had the electricity department instituted a scheme for hiring out such apparatus at reasonable rates. The design of cookers of several makes had, however, now become so far standardised that in all probability a hiring scheme would soon be inaugurated, and a considerable number of consumers had expressed

a desire to give electric cooking a trial immediately such a scheme was put into operation.

The increase in the heating and cooking output had been almost solely the result of the special charge of 15 per cent. per annum on the net rateable value of the premises, plus ½d. per unit for all current consumed, as registered by meter (which was provided free of rental charge), and of recommendations made by consumers to their friends after personal experience of the use of electric heating and cooking apparatus.

In his opinion no great headway would be made by any supply undertaking working in an area where gas was supplied at 3s. per thousand cubic feet or under, unless electrical energy for such purposes was supplied at a price not exceeding ½d. per unit. The author was of opinion that such a tariff was remunerative, provided that a resonable fixed charge was also made.

The lower the price charged for current the higher will be the load-factor of the supply. This had been proved to be the case in connection with lighting and power supplies. The question of load-factor was not of such great importance when dealing with cooking loads as when applied to heating loads. Leaving out exceptional cases, cooking loads must be intermittent, and a low tariff could only be justified by reason of their great diversity factor. Radiators and convectors would only be used for occasional purposes where a high tariff was imposed, but with the reduction of the tariff they would become more and more popular for all-day heating. (See table.)

Statement showing Total Number of Units Sold to Consumers who have adopted the Special Domestic Rate each year since its institution.

Year ended.	Units.
December 31st, 1910 (six months only) ...	53,733
December 31st, 1911	263,618
December 31st, 1912	435,765

When considering the best method of applying electricity for heating purposes, the actual requirements of the case should be taken carefully into consideration. Should the heater only be required for intermittent use, or to provide warmth immediately, a radiator should be installed. If, however, it was desired to warm the whole of an apartment in the shortest possible time, and to maintain the warmth afterwards, a convector would be found most suitable.

It has been found by the author that to obtain satisfactory heating the consumption of the heater should not be less than 1 watt per cb. ft. of the apartment to be heated. In apartments where there are a number of doors or windows, or the door is being continually left open, the consumption should be greater. Now that current is obtainable at ½d. per unit, and cheaper designs of radiators and convectors have been evolved, it is quite common for two and three-unit heaters to be installed, with the result that satisfactory heating effects are obtained.

The luminous radiator of Mr. H. J. Dowsing is as efficient as any on the market, and it is advisable that this form or some modification thereof should always be used when luminous radiators are adopted.

In some designs of lamp radiators which have come under the author's notice, the lamps are more or less hidden at the top, bottom, or sides of the radiator by some portion of the body. This tends to cause overheating of the lamps, and to shorten their life. Overheating of the lamp holders also results, with consequent trouble with their contacts, and further reduction in the efficiency of the heater as a whole. Designers of radiators should always bear in mind that the object for which a heater is required is to give off as much heat as possible, and not to retain the heat in its body. This object can only be achieved by allowing the air to have as free access as possible to the heater, in order to reduce the temperature of its parts, and, in the case of radiators, to design the body so that there is as little obstruction as possible to the rays of heat given out by the elements. There are many luminous radiators on the market which do not comply with the above conditions.

Bastian and other types of open glowers should be guarded to prevent fire occurring through inflammable materials touching the elements, and should not be mounted too close to the floor unless the latter is well heat insulated, as it is found that these types of heaters throw a considerable amount of heat downwards. The connections to the heating elements should be of good mechanical construction, simple clips, such as are often used, being a source of great trouble, especially if the glowers are of high capacity, as in course of time, through the continual expansion and contraction which takes place, the clip becomes loose.

The type of radiator known as the Ferranti fire is very efficient. The usual form in which this is made is that of a metal bowl some 18 in. in diameter, in the centre of which is fitted a hot plate covered with a quartz disk. After current has been switched on for some little time both the face of the hot plate and the disk become red hot, giving the heater a cheerful appearance, and the formation of the metal bowl causes the radiant heat to be well thrown out into the room. In using this type of heater, care must be taken to prevent inflammable materials from touching the quartz disk.

Many convectors are made with insufficient air inlets, and the outlets are often considerably baffled. This causes over-heating of the elements and contacts, and tends to reduce the efficiency of the heater. In a recent case which came under the author's notice, a convector was returned by a consumer on the ground that the heat given off was insufficient, and with the request that additional heating elements should be inserted. The capacity of the convector was increased by adding further elements, which were of wire wound on mica strips, the air openings in the lower part of the body were increased by 100 per cent., and the baffle plate, which had been fixed above the original elements, was removed. On the heater being returned to the consumer it gave every satisfaction, so much so that the additional heating units were not required, the temperature of the room being maintained with less consumption than was the case when the convector was used in its original condition.

A simple and effective form of convector is that known as the G.E.C. tube heater, in which radiator lamps are fitted inside metal tubes of about twice the lamp's diameter. In this case the radiant heat of the lamps is not utilised directly for warming the room, but to heat up the enclosing metal tubes, which in turn heat the air which passes rapidly through them.

Radio-convectors have during the past few years become very popular. These usually consist of a four-light luminous radiator at the back of which are arranged a number of coils forming a convector. By combining the two forms of heaters a very satisfactory result is obtained.

Generally speaking the electric heater can only compete with other forms of heaters by reason of its adaptability, and the fact that the whole of the heat units given off by it can be efficiently utilised. In preparing schemes for electric heating, therefore, it is most desirable that the whole of the conditions should be thoroughly studied and the heat applied in the most suitable manner and positions.

One of the first firms to make a serious attempt to put a practical cooking outfit on the market at a reasonable price was the Berry Construction Co., Ltd., whose "Tricity" cooker has had a very considerable sale, and is well known throughout the country. Very satisfactory results have been obtained from the use of this outfit, but it has been found by experience to have a number of disadvantages. Amongst these may be mentioned the following:—

The flexible connections to the hot-plate on the top of the oven and the extension cooker are often found to be in the way, and, as is the case with all flexibles, faults develop where the wire is attached to the plug or to the plate. The plugs also after a time make bad contact owing to the pins losing their spring through constant use. When this happens, either the plug heats up the fuses, or, as had been the case on a number of occasions, the contact is so bad as to prevent current passing to the hot-plate, with consequent loss of heat in the oven and spoiling of the food being cooked. Another great disadvantage which is found in connection with this outfit is its novelty of construction, which causes it to fail to appeal to the average cook, who is usually of a conservative disposition. Having been used to coal fires and gas ranges, the cook naturally prefers that an electric cooker should be constructed somewhat on the same lines, and for this reason electric ovens designed on somewhat similar lines to gas stoves are now becoming the standard article provided for electric cooking purposes.

The majority of manufacturers, however, cannot be said to have yet settled down to what may be regarded as standard lines, as they do not seem to have sufficiently studied the requirements of the various classes of people for which they have to cater.

The varying requirements of different parts of the country have also not been realised. Most electric stoves appear to have been designed to suit London conditions, and the ovens made sufficiently large to cook a small joint and pastry. On introducing these ovens in Bradford, it was soon ascertained that they would not meet the local conditions, as one of the first requirements for an oven in the West Riding seems to be that it should be capable of baking bread, whereas in London and in most towns in the south it is unusual for bread baking to be carried out at home. The internal dimensions of the cookers originally supplied were too small to accommodate the usual baking of half a stone of bread. In addition to this, the elements in some types of ovens were arranged round the sides, and as, in connection with the baking of bread, it is generally conceded that a bottom heat gives the best results, and as the majority of coal ovens in Bradford are so arranged that the most intense heat is at the bottom, the consumers who tried the electric ovens could not obtain satisfactory results from them. In London and the south, cooks have become quite used to side heat by reason of the general use of gas stoves; and in the case of coal-fired ovens for domestic use, the most intense heat is applied at their tops.

The ovens should be provided with at least three separate sets of heating elements, so controlled that not less than three regulations are provided. It is advisable that the capacity of the heating elements should be such that two sets are capable of maintaining sufficient heat for all ordinary baking operations. The advantage of this arrangement is that the oven can be quickly brought up to full heat by the use of all three elements, and that in the event of the failure of one of them, the remaining two would provide sufficient heat to complete the operations in hand without spoiling the food.

It would appear an advantage if ovens were constructed so that a glowing type of unit could be used for the cooking of meat, and controlled by a series-parallel arrangement, so that the heat in each individual element could be reduced when bread or pastry was being baked.

A thermometer of the mercurial type, protected from injury, should be provided on the door or other convenient portion of the oven, and a table of temperatures and instructions as to the heats required for the cooking of various dishes should be sent out with each cooker.

Glass panels are provided by some makers in the door of the oven, and these are of unquestionable use if the heating elements used glow sufficiently to provide enough light to enable one to see the food being cooked.

It is generally found that two hot plates and one grill mounted above the oven are sufficient for all ordinary purposes. The hot plates should be so arranged that either the plate as a whole, or the heating element, can be easily removed for the purpose of repair, otherwise repairs prove costly and of great inconvenience to the persons in whose houses the cookers are installed.

A flat plate of not smaller dimensions than 36 in. × 18 in. should be fitted at the top of the oven, level with the base of the hot plates, so that cooking utensils, dishes, plates, &c., may be stood thereon. This plate should be left bright and kept clean.

The space between the underside of the hot plate and the oven should be utilised partly as a hot cupboard for warming dishes, plates, &c., and partly as a grill, the grill elements being fixed to the underside of the plate. The grill should be of not less dimensions than 12 in. × 8 in., and should be arranged with two heats, so that one half of the heating elements can be used if found desirable. Arrangements should be made so that the grid on which the article to be grilled is placed can be supported at varying distances from the elements.

The whole of the heating units should be separately switched and fused. Each hot plate should be provided with at least two, and preferably three, regulations of heat in the proportions of quarter, half and full, the regulation being provided by a Diamond "H" switch having one "off" and three "on" contacts. The switches and fuses should preferably be mounted on a board. On the same board should be mounted a main double-pole switch, so connected that it can be used to cut off entirely the supply of the cooker, sub-switches and fuses. A pilot lamp should also be mounted on this board, unless one is fitted on the stove itself. The pilot lamp should be separately fused.

The wires between the cooker and the switchboard should be enclosed in flexible metallic tubing, and the whole of the metal portion of the apparatus, apart from the electrical circuits, efficiently earthed.

Where a cooker is supplied from a circuit of which one pole is maintained at earth potential, if plug connections are used for all or any of the various circuits, the pins of the plugs should be of different diameters or some other device used to prevent change of polarity, otherwise single-pole sub-fuses will afford no protection.

With a hot plate the heat is transmitted to the containing vessel entirely by reason of the conductivity of the materials employed. Unless, therefore, the bottom of the utensil bears evenly throughout the whole of its area on the surface of the hot plate, points of excessive local heating occur at the places where the vessel touches the plate. If water is being heated, a rapid convective action takes place at these points, and the heat units are thereby distributed throughout the whole of the liquid. In the case of milk, gravies and similar thick liquids, however, the convective action is so slow that the heat cannot be transmitted from the bottom of the vessel sufficiently rapidly to prevent an excessive rise in temperature, with the result that burning takes place. These facts should be borne in mind when choosing utensils for use on hot plates.

The best results are obtainable with stiffly constructed vessels, such as those made of cast-iron or cast aluminium, having machine-ground or turned bottom surfaces of fair thickness. Excellent contact is made by such vessels with the turned surface of the hot-plate, which contact, owing to the vessels' rigid construction, is not broken by buckling. In addition to this, due to the thickness of the metal in the base of the utensil, the heat, even if absorbed unequally over its under-surface, is equalised by the rapid conduction which takes place in the metal itself before reaching the surface exposed to the liquid. Not only does the use of such utensils tend to prevent the burning of food, but the heating is more rapid, and, therefore, more efficient.

Enamelled iron utensils have been found very unsuitable for use with hot-plates.

Mr. T. Harding Churton said he thought that if Mr. Roles had been in America recently, he would have felt that the United Kingdom was a long way behind. As to the use of radiators at 1d. per unit, he had come to the conclusion that to heat a room of any considerable dimensions was rather an expensive matter. In small rooms, such as dressing rooms and the like, a radiator was very nice indeed. He found the cost of a coal fire was ½d. an hour, whilst that of the radiator was 1d. per hour, and the coal fire did very much better service. It would require half a dozen radiators to make much difference to the temperature of an ordinary living room. However, they were handy for supplying warmth to the individual, as they could be moved about the room for that purpose.

Mr. W. B. Woodhouse said he thought the great advantage of electric cooking was the convenience of it. From Mr. Roles's paper he worked it out that to treat a house rated at £50 would involve a heating bill of something like £80. He considered that Mr. Roles made out a very strong case against the Marylebone or Telephone Tariff, because where there was a plug by which the customer could connect anything he liked, it would be extremely difficult to apply accurately such a tariff. He thought Mr. Roles was claiming too much in saying that he was supplying current for domestic cooking and heating at a ½d. per unit. There was the rateable value charge to take into account. Cooking would give them a Sunday load, and that might become a very important thing. He thought the tendency to copy the form of the gas stoves was wrong. Far better would it be for the makers to develop a stove which was absolutely right in type for electrical use, and then to persuade the public that, though different from the gas stove, it was better than it.

Mr. A. B. Mountain said many years ago he persuaded the Huddersfield Corporation to spend a good many hundreds of pounds in establishing a showroom and buying fittings for hiring, and so far as cooking was concerned it was a great failure. The great difficulty was the lady problem. The wealthy ladies left the matter to the servants; what he might call the economical genteel class could not afford the appliances, and the working class at once raised the question of how to boil water. His experience of radiators agreed with Mr. Churton's.

Mr. H. Vesger said he did not think any reasonable man would suggest heating a house with radiators under present conditions of price of energy, though the radiators might be a most excellent thing for old people and babies going to bed and getting up in the morning. There was no comparison between heating an ordinary sized room with radiators and with anthracite coal. As to cooking, he thought there was distinctly a field for it. The enormous advantage of cleanliness was most obvious. A single unit "Tricity" cooker was most useful and economical for cooking odd things in case of sickness and so forth.

Dr. R. Pohl said he had seen German figures which led him to the conclusion that ½d. per unit for electric current and 2s. 5d. per 1,000 cb. ft. for gas, amounted to exactly equal cost for cooking. These figures, however, related to individually heated vessels, and he believed that the efficiency of these was 80 or 90 per cent., whereas the efficiency of the stoves which were so largely used now would not be more than 60 per cent., and, therefore, would be about 40 per cent. more expensive in working than the individually heated vessels. In regard to the load factor point of view, he thought that Mr. Roles had rather under-estimated the importance of the fact that cooking went on in summer as well as winter, whereas heating was in winter only.

Mr. W. Lang thought that Mr. Roles might well have dealt with the claims which were made as to the saving in weight of food by the electric cooking, and also the better flavour, the absence of loss of juices, and the increased pleasure of eating the food. A difficulty which operated against the manufacture of ovens was that the disks for heating the vessels had to be made of very light castings, and in use they were liable to buckle, and so the uniformity of surface for the vessels to rest upon was spoiled, and when the pots and pans were resting upon two or three points only, the advantage of the heat was largely lost. As to heating, he thought that by a very simple arrangement the fresh air admitted into a room by a wall ventilator could be heated by means of a small electric heater fitted into the wall.

Mr. Albert Innes, speaking upon the subject from the contractor's point of view, referred particularly to difficulties in educating the customers. There was great difficulty in persuading ladies that convectors were better than radiators for heating rooms.

Mr. E. C. Wallis testified to the great usefulness of radiators in case of illness.

Mr. Hamm, of York, said he had been very gratified at the fewness of the cases in which electric cookers had been returned. He thought the public liked the cookers very much indeed, and at York the authorities were only waiting to see whether the popular favour was permanent before going into the provision of more cookers. There were difficulties sometimes—as, for instance, when, as he remembered in one case, cooking was attempted on a small "Tricity" cooker for a family of 12, who had hot lunch every day, and hot dinners most evenings—in hitting upon the right size and style of apparatus. Obviously the possibilities of electrical heating were limited, but he knew of a case in which a church at York was heated solely by electricity, and though it was a very old and damp church the results were satisfactory. It was done by double tiers of tubes about four inches in diameter, and six tubes high running right round the building. He believed the cost was about 6s. or 7s. per Sunday, and the people concerned seemed to think that it was worth the money. Though he had started with the greatest doubt about electric cooking, he now thought it had come to stay.

Mr. Campion, of Dewsbury, said it was a very good thing that the makers were now prepared to enter into contracts for the maintenance of the elements of the ovens.

Mr. Roles, in his reply, said that, notwithstanding Mr. Churton's observations, all the information that he had been able to gather suggested that the Americans were not up to the standard of this country in regard to cooking and ovens. He had not advised anyone to attempt to heat a house all through by electricity. If people began to do that, he would have to start another works. One advantage of the electric cooker was that it was safer than the gas cookers, with which many accidents happened. In Bradford the people who were chiefly taking an interest in electric cooking, were people living in houses rated at from £20 to £35 a year, who had little domestic help and wanted apparatus that they could use with safety and cleanliness themselves, the lady doing the cooking whilst the one servant did the rougher work, and for these people the electric cooker was very much better than the gas stove. With regard to saving in weight of meat, results obtained by himself showed very material advantages in favour of electric cooking.

The subject was further discussed at Sheffield, on March 26th.

Mr. King said that he desired to consider the matter of electrical heating and cooking from the point of view of the man in residence, for with such an individual practically the only question was that of cost. For the purposes of comparison he took a nine-roomed house, containing an average family of five grown-up people in Sheffield. Such a family would spend about £13 per annum on electricity for lighting, gas for boiling water and cooking purposes at only 1s. 3d. per thousand, and £8 2s. for coal for heating for the year. In the case of greater use of electricity for a house and family of the same size, he estimated that for lighting, heating and cooking purposes they would require 5.271 units per annum in total, and, working this out on Mr. Roles's basis of 15 per cent. on the rateable value and ½d. per unit, the cost would come to £17 16s. 6d. There was thus a difference of between £4 and £5,

and in order to make it worth a person's while to go in for electric cooking and heating they would have to save the amount of the difference. Some saving would be made in dispensing with a certain amount of labour in house cleaning and so on. In regard to the matter of diversity factor they would all probably have noticed for themselves that persons went to work at different times in the morning, and therefore they also had their breakfasts at different hours. It was absolutely necessary to have red heat for grilling and to have black heat for baking.

Mr. E. J. Marsh said that electrical cooking and heating offered a great field for electrical engineers. In the past the trouble had been that lightly built materials had been used, and the designs soon became obsolete.

The Chairman (Mr. Wilson Hartnell) said that years ago he had made experiments with a gas oven in order to find how little gas was being used, but in actual use the consumption of gas was doubled and even trebled. The same thing applied to electric installations. In both cases it was due to carelessness in use.

Mr. Burnand said that it was pretty well recognised that they had to have a fixed charge and a charge according to the amount of current used, and the only point at which that system failed was when the diversity factor was altered. The ideal tariff was one where there was a fixed charge and a charge per unit at a low rate, and also an increased rate at a time of maximum load at the station, and it was possible with this system to make one charge for current for heating and lighting or anything else, and yet get a fair revenue.

Mr. Roles, in reply to the discussion, agreed with the estimates which had been made by Mr. King. He always found that, after persons had commenced using an electrical installation for heating and cooking, they continued with it, and in cases of illness in the house, the occupiers when they had once tried an electric radiator, would, under no consideration, use a gas stove and run the risk of leaving the gas turned on and getting asphyxiated. At the present time he thought the manufacturers were getting down to a standard type of oven, and this, together with the experience of users, showed that the new ovens would not become obsolete in the course of a year or two, as they had done previously. The prices for ovens were dropping, and a satisfactory one could now be obtained for £10 or £11; there did not seem to be any reason for doubting that the prices would drop still further. At the present time he was very anxious to get a two-rate system for shops and smaller consumers. He was not altogether satisfied with the rateable-value system for shops, and yet, at the same time, he could not at present find another system that would suit his purpose.

Recent Developments in the Street Lighting of Manchester.

By S. L. Pearce, M.I.E.E., and H. A. Ratcliff, M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers *at Manchester, February 25th, and London, Birmingham and Glasgow.)*

(Continued from page 498.)

The Portland Street light has a much warmer and more cheerful effect than the comparatively cold light in Princess Street.

The curves (figs. 4 and 5) show the horizontal and vertical components of the illumination on planes 3 ft. 3 in. above the ground, and on the ground level. Table III gives a summary of the actual results obtained. The figures in Table II were obtained with a luminometer, and clearly show that, as regards the intensity of the illumination at a considerable distance from the lamps, the flame arcs give better results than the gas lamps.

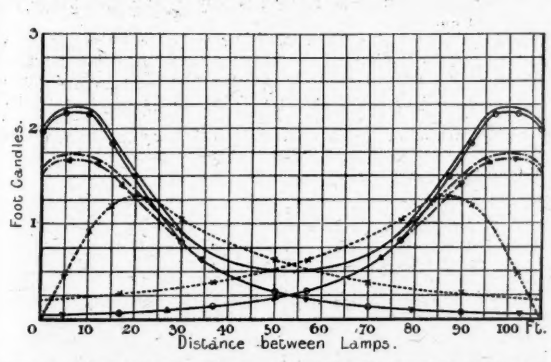


Fig. 4.—Curves showing the results of the photometric tests on the Princess Street three-burner high-pressure gas lamps. Full-line curves represent illumination on a horizontal plane 3 ft. 3 in. above the ground level; dotted curves, the illumination on a vertical plane; chain curves, the illumination on the ground.

Purely from the point of view of illuminating effect, there is much to be said in favour of both systems; but the electric lighting system possesses all the practical advantages, a few of the more important of which are:—

(*a*) Lower cost

(*b*) Simplicity of switching operations, and possibility of dispensing with lamplighters.

(*c*) Flexibility and ease of erection.

(*d*) Lamps not affected by vibration when suspended from traction poles.

(*e*) Possibility of reliable check on running costs (*i.e.*, current consumption and carbons).

(*f*) Negligible leakage.

(*g*) Absence of globe breakages due to heating, &c.

All the above advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use:—

(*a*) Extensive and highly dangerous leakage of high-pressure gas.

(*b*) The detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candle-power just at a time when it is most required.

(*c*) Partial and occasionally complete failure in frosty weather.

Portland Street is a most unsatisfactory street to illuminate, owing to the nature of the buildings and the absence of any appreciable amount of reflection; nevertheless, the present lighting is

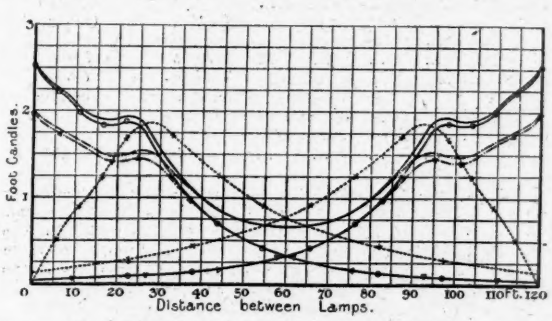


Fig. 5.—Curves showing the results of the photometric tests on the Portland Street 550-watt lamps, fitted with the latest type of outer globe having a graded frosting. Full-line curves represent illumination on a horizontal plane 3 ft. 3 in. above the ground level; dotted curves, the illumination on a vertical plane; chain curves, the illumination on the ground. The elimination of the shadows under the lamps should be noted.

probably as good an example as will be found elsewhere of uniform street lighting with a high average intensity of illumination on the horizontal plane, and a reasonable absence of glare.

The minimum intensity of the illumination on a horizontal plane 3 ft. 3 in. above the ground is, with unimportant exceptions, 0·5 ft.-candle, and the ratio of maximum to minimum illumination in the centre of the road is 3·75. The ratio of the maximum to the minimum illumination on the horizontal plane may conveniently be referred to as the "variation factor."

When carefully analysed it will be noticed that the experts' reports very closely confirm the values of candle-power and illumination claimed by the Corporation Electricity Department as a result of the tests made by their own staff.

Mr. Abady refers to the meaning of "illumination" and the difficulties incidental to its measurement. Throughout this paper, illumination has been regarded as the equivalent of impressed light flux density multiplied by the cosine of the angle of incidence.

Apart from actual values, the proportionality of Mr. Abady's figures for the illumination of Portland Street and Princess Street is in fairly complete agreement both with the electricity department's and Mr. Harrison's results; and his values for the candle-powers of the Princess Street lamps provide important confirmation not only of the electricity department's tests, but also of the fact that the lamps were not giving anything like the candle-power claimed by the manufacturers.

This result is both interesting and important, for it has always been the experience of the authors that gas lamps give substantially lower candle-powers than the values claimed by the manufacturers. This is evident from the figures given in Table I.

TABLE I.

Description of lamp.	Year of test.	Rated candle-power.	Actual maximum c.p. (Average results.)
Keith 3-burner high-pressure gas	1912	4,500	2,300
Keith 2-burner high-pressure gas	1912	3,000	1,630
Keith, single-burner high-pressure gas	1912	1,500	725
Welsbach-Kern, twin-burner	1907	1,200	655
Suggs "Belgravia"	1907	1,800	1,025
Lucas "Thermopile" ...	1907	1,250	765
Intensified gas, Sackville Street	1904	1,000	525

In Appendix A is set forth the method of arriving at the cost of the current under the conditions that obtain in Portland Street.

The totals for "fixed" and "running" costs respectively are arrived at in the manner shown.

The resultant figures are £6·133 per kilowatt of demand plus 0·232d. per unit metered. Applying these values as shown in Appendix B, the costs of the current for the 11 o'clock and for the all-night lamps respectively come to 0·97d. and 0·6d. per unit.

Appendix C contains a statement of all costs involved in lighting Portland Street.

Appendix D is a statement showing the cost per lamp per annum of lighting Princess Street, as given by Mr. Abady in his report.

The following particulars of the lighting in Princess Street and Portland Street are extracted from Mr. Hadyn Harrison's report. In order to make the figures strictly comparable, the Portland Street lamps are assumed to be all switched out at 11 p.m.

	Princess Street high-pressure gas.	Portland Street arcs.
Candle-power of lamps	1,750	2,970
Number of lamps to the mile ...	49·34	43·6
Running costs per lamp per hour ...	1·5d.	0·7d.
Capital cost per mile of street ...	£2,537	£1,569
Running cost per 1,000 C P.-hours ...	0·857d.	0·236d.
Cost per annum per mile, equal illumination	£675	£254
Minimum illumination, basis of comparison	0·39 ft.-candle	0·5 ft.-candle
Cost per mile of street per annum (up to 11 o'clock) at above illumination	£617	£254

The high-pressure gas lighting in Mosley Street is a very poor display compared with the arc lighting. It is also a very poor display of high-pressure gas lighting. An illumination on the horizontal plane 5 ft. above the ground level equal to 0·5 ft.-candle is only obtained up to a distance of 22 ft. from the bases of the lamp-posts, and the minimum midway between the posts is only 0·07 ft.-candle, the "variation factor" being as high as 43.

St. Peter's Square is distinctly a better example of high-pressure gas lighting, and compares favourably with the flame arc lighting in Albert Square. The illumination on a horizontal plane 5 ft. above ground level is maintained at a sufficiently high value, and is equal to 0·5 ft.-candle in all parts where there is any great amount of traffic.

The 500-watt lamps in Albert Square are fitted with slightly opalescent globes, and are mounted on poles at a height of 22 ft. 8 in. above the ground. The illumination is fairly uniform.

The average horizontal illumination in Piccadilly is well over 1 ft.-candle, and in no part where there is any appreciable amount of traffic is it less than 0·5 ft.-candle. The roadway is lighted by means of 12 500 and four 550-watt lamps fitted with clear inner and outer globes, and fixed on the tramway standards at a height of about 27 ft. 6 in. above the ground. In addition, there are also 10 450-watt lamps on the esplanade. These lamps have opalescent bowl-shaped globes. They are suspended from swan-necked pole-brackets at a height of 18 ft. 6 in.

The reading tests and observations in Table II refer to clear weather; there is no question as to the superior penetrating power of the rays from the arc lamps in foggy weather.

TABLE II.

Sizes of type.	Maximum distance at which distinctly readable. High-pressure gas.	Flame arcs.
Large (Pica Doric) ...	339·0 ft.	371·5 ft.
Medium (Small Pica)...	265·0 ft.	313·0 ft.
Small (Brevier) ...	212·5 ft.	242·0 ft.

All figures are the average of not less than six sets of observations taken on different nights.

A very considerable amount of testing and experimental work has been undertaken in order to discover, if possible, the most satisfactory type of outer and inner globe for use under the conditions obtaining in Portland Street, and to comply with the following requirements:—

Reasonably uniform illumination; absence of glare; moderate cost of globes; light distribution not affected by slight alteration in the position of the arc; maximum candle-power approximately between the 20° and 25° rays below the horizontal.

The light distribution with the original globes was anything but satisfactory, and the glare was very objectionable.

The first attempt to overcome these defects was by the use of opalescent outer globes of the same shape as the clear globes. The result was a distinct diminution of the shadows under the lamps, and the complete disappearance of the concentric rings: but unfortunately the light distribution was very considerably reduced, and the dark gaps midway between the lamps were very noticeable.

Various types of dioptric and inner diffusing globes were then tried, but without appreciable success. This lack of success was no doubt due in a great measure to the position of the arc and the shape of the original outer globes. It was not until the type of outer globe now in use had been adopted that any headway was made with the various attempts to improve the light distribution (see fig. 3).

Fig. 6 shows the polar curve for the 11-ampere lamp fitted with the clear inner and outer globes. This curve possesses many excellent features, but can be modified with considerable advantage. For street-lighting work, the upper portion of the curve between 15° and 25° from the horizontal is of most importance,

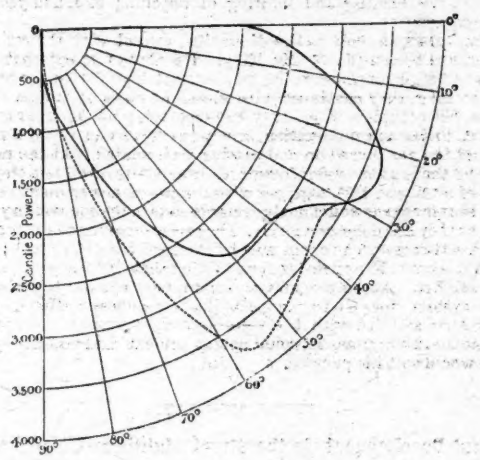


FIG. 6.—Polar curve for 550-watt flame arc lamp as used in Portland Street. The dotted portion shows the effect of the original experimental obscuration. Tested with "old type" carbons.

but the portion between the 40° and 65° rays could be reduced with advantage. The absence of appreciable candle-power between 80° and 90° is a result of the rather pronounced shadows cast by the ash-trays.

The first attempt to reduce the distribution of light between the 40° and 65° rays, and at the same time to improve the distribution in the neighbourhood of 20° below the horizontal, was by the use of dioptric globes. The results were not entirely successful.

These tests seem to demonstrate very clearly a rather objectionable feature of dioptric globes, namely, the strongly defined optical centre, in consequence of which the light distribution is very considerably distorted if there is any appreciable change in the arc position.

It is very probable that the open lower end of the dioptric globe is largely responsible for the very marked dip in the polar curve.

Attempts were made to modify the shape of the polar curve by suitable obscuration of the outer globes, and it was owing to the success of the early attempts that further investigations were conducted upon these lines. The necessary obscuration was

TABLE III.

Description of lamp.	Where situated.	Height above ground level.	Maximum candle-power. Average results.	Illuminations on horizontal plane in foot-candles. Maximum at centre of road.	Minimum at Centre of road.	Minimum at Building-line.	Height of measuring plane.	Variation factor. Centre of road.	Variation factor. Maximum.
550-watt flame arcs, original globes. Outer globe opalescent	Portland Street	27 ft. 6 in.	2,250	3·14	0·370	0·280	5 ft.	8·50	11·20
550-watt flame arcs. New type inner and outer globes. Final graded frosting	Portland Street	27 ft. 6 in.	3,560	2·50 2·00	0·670 0·670	0·500 0·500	3 ft. 3 in. Gr'nd level	3·75 * 3·00	5·00 4·00
550-watt flame arcs. Clear inner and outer globes	Piccadilly	25 ft. 6 in.	3,580	5·95	0·760	0·500	5 ft.	7·85	11·90
Keith 3-burner high-pressure gas	Princess Street	26 ft. 6 in.	2,300	2·23	0·575	0·400	3 ft. 3 in.	3·88	5·58
Keith single-burner, high-pres-gas	St. Peter's Square	17 ft.	725	* 2·45	0·180	0·120	5 ft.	13·6	20·4

* These values are the maxima obtained approximately 5 ft. from the posts and not at centre of road.

at first obtained by the application of whitening on the inside of the lower portion of the outer globe.

Globes obscured in this manner have actually been in use in Portland Street for over six months, and no doubt the slight difference between the test results obtained by the Corporation's own staff and the independent experts are traceable to the variable nature of this obscuration, and also to changes in the type of carbons used.

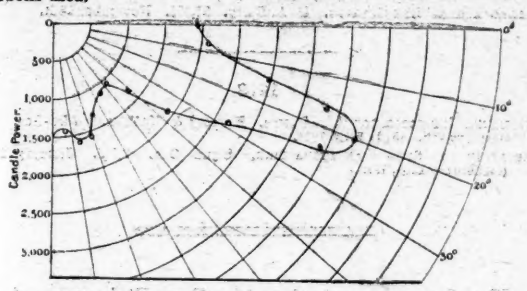


FIG. 7.—Polar curve for 550-watt lamp with dioptric inner globe and clear outer globe with dense frosting up to 48° above horizontal.

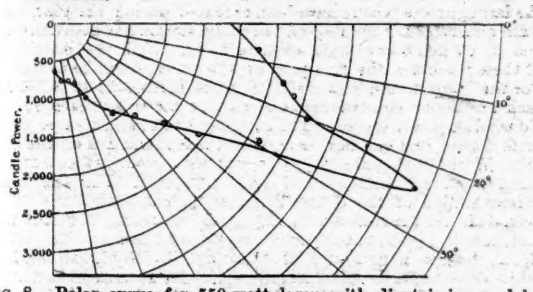


FIG. 8.—Polar curve for 550-watt lamp with dioptric inner globe and clear outer globe with graded frosting tapering off to 40° above horizontal.

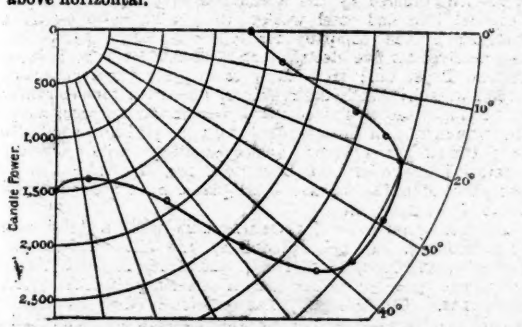


FIG. 9.—Polar curve for 550-watt lamp, fitted with clear inner and outer globes, as shown in fig. 3 (full lines), and having a graded frosting on the lower portion of the outer globe. The frosting is densest at the bottom of the globe, and disappears at an angle of about 40° below the horizontal.

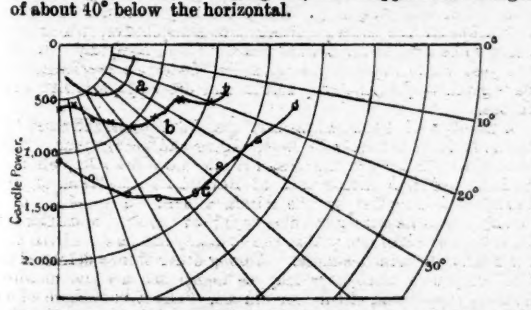


FIG. 10.—Polar curves for Keith high-pressure gas lamps. (*a*) Single-burner; (*b*) twin-burner; (*c*) three-burner.

Attempts were then made to obtain from the globe makers suitably obscured globes, but the greatest difficulty was experienced in obtaining exactly what was required. No manufacturer would undertake to give a graded effect, at any rate on a diffracting globe, although a flashed opalescent globe with a graded effect on the lower portion was eventually obtained.

The experimental etching of globes was therefore undertaken. The globes were clamped on to a special lead stand and filled to the desired height with the etching acid. The grading effect was then obtained by allowing the acid to run out of the globe through an adjustable orifice in the lead stand, and any desired degree of frosting could be obtained by regulating the rate of flow.

Figs. 7 and 8 show polar curves obtained with different combinations of globes, and it is obvious that they are very suitable for giving a fairly uniform illumination on a horizontal plane.

(To be concluded.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

NORTHERN RHODESIA.—The Board of Trade has issued a copy of a new Customs tariff of Northern Rhodesia. The new tariff divides the country into two zones: the Zambesi basin and the Congo basin, and deals with these zones separately. The "general" rates of duty in the Zambesi are practically identical with those in the South African Customs Union, but the preferential rates of duty leviable on British goods are in some cases lower. In the case of the Congo basin no provision is made for the preferential treatment of British goods. In any case electrical plant and machinery, and tramway material, are duty free.

The certificates of origin necessary in order to obtain entrance for British goods under the lower preferential rates are the same as those already in force for the South African Customs Union.

The new tariff has effect from February 1st last.

SIAM.—The *Board of Trade Journal* reports that the Director-General of Customs and Excise at Bangkok has issued a notice laying down regulations with regard to the entry of goods for importation and exportation; the regulations were to come into force on Tuesday last, and are as follows:—

1. The entries must be made in the form prescribed by the Department.

2. The goods must be denominated in strict accordance with the classification shown in the official Import and Export List.

3. Particulars of quantity and value must be furnished for each separate kind or class of goods, and quantities must be given in the terms of the Import and Export List.

4. The country from which the goods are consigned, in the case of imports, and the country to which they are consigned, in the case of exports, must be declared for each separate kind or class.

The Department, it is stated, will not accept entries which are not in accordance with these regulations, which have been framed with a view to providing more complete and accurate statistical information; and it is the intention of the Siamese Government to enforce them at all the ports of Siam.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

6,513. "Electrical device to enable several spindles to be driven synchronously as required in cinema and gramophone shows, and in like cases." W. J. Swain. March 17th.

6,544. "Apparatus for regulating the ignition of internal-combustion engines." Sir A. W. Ruyssenaers. (Convention date, March 18th, 1912, Germany.) March 17th. (Complete.)

6,551. "Sockets and terminals for electric leads." A. G. Bloxam (firm of R. Bosch, Germany). March 17th. (Complete.)

6,581. "Electric incandescent lampholders." S. W. Martyn. March 17th.

6,602. "Electric lamps." W. E. Bladon. March 17th.

6,603. "Device for the improved stopping of pulley automatic electric lifts." J. W. Sugden. March 17th.

6,647. "Manufacture of insulated windings or coils for electrical purposes." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) March 18th. (Complete.)

6,648. "Commutators for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) March 18th. (Complete.)

6,664. "Circuit arrangements for semi-automatic telephone systems." Siemens & Halske Akt.-Ges. (Convention date, March 19th, 1912, Germany.) March 18th. (Complete.)

6,668. "Process and apparatus for the electrical treatment of cellulose and other substances of which it forms the essential part." A. L. C. Nodon. (Convention date, March 26th, 1912, France.) March 18th. (Complete.)

6,673. "Portable electric battery lamps." A. Merzel and B. Pordes, trading as United Electrical Manufacturers Co. March 18th. (Complete.)

6,700. "Electric safety lamps." P. Wolf. March 18th. (Complete.)

6,730. "Switches and other electrical apparatus where circuit is made and broken." F. Duret. March 19th.

6,738. "Electric lamps." F. Westwood. March 19th.

6,739. "Safety-wired conduit for electrical installation in mines and all electrical purposes." L. J. Roderick. March 19th.

6,757. "Combined wall plugs and switches." B. P. K. Walsh. March 19th.

6,764. "Electric lamps." H. Rodkjaer. March 19th.

6,767. "Transmitting apparatus for electric switches." Western Electric Co., Ltd. (Western Electric Co., United States.) (Divided application on 25,382 of 1912, November 5th, 1912.) March 19th. (Complete.)

6,768. "Paper-lift mechanism." Western Electric Co., Ltd. (Western Electric Co., United States.) (Divided application on 25,382 of 1912, November 5th, 1912.) March 19th. (Complete.)

6,772. "Distance-operated mechanisms and signals on electric supply systems." H. W. Handcock, A. H. Dykes and W. Duddell. (Addition to 6,716 of 1912.) March 19th. (Complete.)

6,776. "Electric incandescent lampholders." S. W. Martyn. March 19th.

6,799. "Electric transformer arrangements." British Electric Transformer Co., Ltd., and R. Crosbie-Hill. March 19th.

6,800. "Electric clocks." Coventry Electric Clock Co., Ltd., and T. Rushton. (Addition to 14,646 of 1911.) March 19th.

6,806. "Electrical regenerative motor control systems." Crompton & Co., Ltd., and H. Burge. March 19th. (Complete.)

6,807. "Electrical distribution systems." British Thomson-Houston Co., Ltd., and E. B. Wedmore. (Divided application on 28,868/11, July 22nd, 1912.) March 19th. (Complete.)

6,817. "Electric cables." A. T. Mirza. March 19th.

6,884. "Reversible double electric fuse." W. Patterson. March 20th.

6,873. "Electrical switches." British L.M. Ericsson Manufacturing Co., Ltd., and A. G. Rogers. March 20th. (Complete.)

6,875. "Incandescent electric lamps." G. E. Godin and A. A. Godin. March 20th.

6,880. "Fuses for electric circuits." Siemens-Schuckertwerke G.m.b.H. (Convention date, March 21st, 1912, Germany.) March 20th. (Complete.)

6,891. "Synchronous dynamo-electric machines." E. Rosenberg. March 20th.

6,897. "Process and apparatus for the production of copper by electrolysis." M. P. Lloyd. (Convention date, March 22nd, 1912, France.) March 20th. (Complete.)

6,900. "Means for protecting direct-current working electrical instruments from being operated by extraneous or unauthorised currents which may reach the line to the instruments by accident or design and a relay for the same and like purposes." R. Dorner. March 20th.

6,901. "Electric candle fittings." F. Hodgson. March 20th.

6,902. "Microphones especially applicable to wireless telephony." G. E. Heyl, E. Sanger-Shepherd and T. T. Baker. March 20th.

6,911. "Process for manufacturing articles or objects of tungsten." O. Voigtlander. (Convention date, March 23rd, 1912, Germany.) March 20th. (Complete.)

6,933. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., F. R. Clough and L. Dunker. March 20th.

6,934. "Electric clock control." Allgemeine-Elektricitats-Ges. (Convention date, March 22nd, 1912, Germany.) March 20th. (Complete.)

6,936. "Circuit arrangements for registering subscribers' calls in semi-automatic telephone installations." Siemens & Halske Akt.-Ges. (Convention date, March 21st, 1912, Germany.) March 20th. (Complete.)

6,950. "Electric dry batteries." S. Stern. (C. Hubert, United States.) March 20th.

6,952. "Electric furnaces for treating metallic filaments." G. Ludecke and Brimsdown Lamp Works, Ltd. March 20th. (Complete.)

6,964. "Electric arc lighting." S. L. Pearce and A. Wilkinson. March 22nd.

6,965. "Arc lamp globes." S. L. Pearce and A. Wilkinson. March 22nd.

6,982. "Sealing means for boxes containing electric point controllers, switches, and the like." S. T. Quilliam. March 22nd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Starting and Speed Control Gear for Use with Electric Motors. G. W. Mascord. 26,864. November 30th.

1912.

Electrically-operated Telphers and Tracks therefor. Strachan and Strachan & Henshaw, Ltd. 190. January 2nd. (Cognate application, No. 15,831 of 1912.)

Automatic and Semi-automatic Telephone Circuits. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,820. January 29th.

Electrical Condensers. British Insulated and Helsby Cables, Ltd., and E. A. Bayles. 2,701. February 2nd.

Portable Electric Battery Lamps. H. F. Joel. 5,170. March 1st.

Thermostats. H. H. Grundy. 5,311. March 2nd.

Metal Vapour Alternating-current Rectifiers and Similar Apparatus. Hartmann & Braun Akt.-Ges. 5,845. March 2nd. (March 2nd, 1911.)

Metal Vapour Alternating-current Rectifiers and Similar Apparatus. Hartmann & Braun Akt.-Ges. 5,415. March 4th. (March 2nd, 1911.)

Supports for Lamps. E. I. Parkes. 5,887. March 8th.

Electrical Signalling Apparatus. L. M. Potts. 6,050. March 11th. (November 18th, 1911.)

Holders for Electric Lamps, Electric Switches, Ceiling Roses, Plugs and the Like. A. R. Muller. 6,895. March 14th.

Electrostatic Separating Devices for Sorting Heterogeneous Materials, more especially Minerals, Metallic and Others, Sulphur, Phosphates of Lime and Like Materials. A. M. F. Blanchard. 6,772. March 19th.

Process for the Manufacture of Incandescent Electric Lamp Filaments. R. Jahoda and Elektrische Gluhlampen-Fabrik "Watt" Schard Löti and Latzko. 7,977. April 2nd. (September 30th, 1911.)

Telephones. C. F. Killar and J. C. Grove. 9,714. April 24th.

Oscillation-gaps or Dischargers for Use in Radiotelegraphy, Radiotelephony and Like Purposes. W. Torikata, E. Yokoyama and M. Kitamura. 10,823. May 7th.

Telegraph Systems. E. Pope. 11,604. May 15th.

Apparatus for the Electrolysis of Alkali Chlorides. J. V. Johnson. (Badische Anilin and Soda Fabrik.) 16,779. July 18th.

Instruments for Measuring or Controlling the Frequency or Wave Length of Alternating Currents, or for Indicating Speed. G. Seibt. 16,874. July 19th.

Electrical Generating Set. J. A. Rey. 13,025. August 3rd.

Metal Vapour Alternating-current Rectifiers and Similar Apparatus. Hartmann & Braun Akt.-Ges. 18,603. August 18th. (June 6th, 1911. Divided application on No. 5,414 of 1912, March 4th.)

Telephone System. J. Baumann. 18,677. August 14th. (August 14th, 1911.)

Chemical Generators of Electricity. O. Sozzi. 20,101. September 3rd.

Telephonic Transmitting Appliance. J. K. Rhodes. 20,196. September 4th. (April 6th, 1912.)

Brush-holders for Dynamo-electric Machines. A. E. Berdon. 20,224. September 25th.

Method of Manufacturing Electric Incandescent Lamp Filaments. E. M. Bailey and H. F. McDowell. 20,621. September 10th.

Movable Sleeve Devices to Facilitate the Inspection of Wires in Electric Cables. J. A. Williams. 21,215. (September 18th.)

Electrical Indicating or Alarm Apparatus. E. E. Weikel and D. Weikel. 21,989. September 26th.

Electric Cooking Apparatus, Downe and Brompton and Kensington Accessories Co. 25,688.

Supports for Metallic Filaments of Electric Incandescent Lamps. H. A. Gill. (Wolframlampen Akt.-Ges.) 26,249. November 15th.

Electrical Switches. A. Wynne. 26,517. November 19th. (Divided application on No. 13,196 of 1912, June 5th.)

Telegraphers' Key Cushion. H. A. Kelty. 27,079. November 25th.

1913.

Trimming Indicator for Arc Lamps. Korting & Mathieson Akt.-Ges. 253. January 4th. (July 29th, 1912.)

Receiver for Submarine Signalling. Signal Ges. 2,185. January 27th. (December 18th, 1912.)

The Progress of the Allmäna Elektriska A.B., Sweden.—The report of this company for 1912 contains, according to the *Affärsvärlden*, the following interesting statements about the larger orders which have been executed during the year. The sixth generator for the Trollhättan power station has been delivered, and Nos. 7 and 8 have been taken in hand. With the installation of these machines the first part of the scheme will be completed. For the Bullerforsen power station, three generators of 4,100 KW. each are under construction, and two of 2,600 KW. each for the Uddeholms power station. The company has also had large orders from abroad, and has now completed the construction of the Electrical Works of Copenhagen, for which have been further delivered three cascade transformers of 1,000 KW. each. For the transformer station of the Union Electrica Madrilena, at Madrid, have been delivered generators with an aggregate capacity of 20,000 KW., and electrical plant to the power stations at Linares and La Cruz, in Spain, besides a generator of 4,000 KW. to Nokia, in Finland, while some larger installation orders have been executed in various places in Russia. From Norway the company has received several good orders, among which may be mentioned a generator of 20,000 KW., ordered by the Arendals Fossekompani, for their new electrical iron and steel works. Canada has also been a good customer of the company for larger machines, orders having been received for five electric motors of 2,000 H.P. each, from the Ontario Paper Co.; from Eddy & Co., for three generators of 3,750 KW. each; and from the Calgary Power Co., for two generators of 4,250 KW. each. The company has, during the year, completed the construction of the electrical plant at Ljungfors, consisting of an electrical power station and a smelting furnace transformer plant. These works have been done for the Stockholm Superphosphate Manufactory, and both plants have been designed for about 17,000 KW. each.

Another large order for transformers with a total capacity of 30,000 KW. has been placed by the Alby United Carbide Factories, at Odda, in Norway, and from Arendal the company has got an order for a smelting works plant of 3,000 KW. The company has previously delivered the electrical machinery for the nitrate manufactories at Svälgfoe, in Norway, and has in 1912 supplied generator No. 5 of 10,000 H.P. for their power station. The work in connection with the electrification of the railway from Küruna, in the north of Sweden, to the Norwegian frontier, has made good progress, and the time for its completion is approaching. The same may be said about the electrification of the railway, Stockholm-Saltsjöbaden, which soon is going to be opened for general traffic. The company has during the year made experiments with Diesel-electric carriages, which have given very satisfactory results and are very promising for the future.

A number of 40 tramway carriages have been delivered to the towns of Helsingfors, in Finland, Viborg and Gothenburg. Fifteen electrical winches for the Diesel engine ship *Selandia*, which was built in the shipbuilding yard of Burmeister and Wain, of Copenhagen, were supplied by the Allmäna A-B. The results of the working of same during the first voyage of the ship, and afterwards, have been so satisfactory that the company has now received orders for nearly 100 winches more. Among other things delivered from the company's workshops may be mentioned a large number of hoisting apparatus, chiefly for Russia. The manufacture of electric heating apparatus has increased to such a degree that it has become necessary to establish a separate department for this class of goods.

The Frankfort Dynamo Works.—When the Frankfort Dynamo Works were acquired from the Lahmeyer Co. two years ago apprehensions were entertained by a portion of the staff that the A.E.G. would close the works and transfer manufacturing to Berlin. Although these fears proved to be unfounded a similar idea has now been revived at the works, where several thousands of workers are employed. The A.E.G., however, states that the intention to shut down the works does not exist, although a small portion of the business—the construction of large machines—is to be removed to Berlin. The building of large machines has only been continued at Frankfort until the extension of the Berlin machine works, commenced four years ago, was completed, which is now the case. For the rest all the other departments at Frankfort are being constantly extended, and the development would proceed more rapidly if a larger number of skilled workmen was locally available.